The Welding Engineer

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Founded by L. B. Mackenzie, 1916

JUNE, 1930 VOL. 15, NO. 6

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Performance without Maintenance for 2 years

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The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

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EVERYBODY'S BUSINESS

BY FLOYD W. PARSONS

THINGS that yesterday were mere prophecies have become realities. Motor cars with 16 cylinders and others with front drives are traveling our streets. Music has become visible as well as audible. Signal systems operate day and night without human aid. Robots direct traffic, camera shutters divide seconds into billionths, news is flashed instantly by teletype, and clever mechanical contraptions are performing veritable miracles even to taking the place of a human larynx and restoring a lost voice.

Dreams Come True

We were not sure a few years ago that automobile tunnels could be properly ventilated; that gas could be carried with economy a thousand miles through pipes; that weather hazards in aviation could be conquered; that invisible light waves could be made to serve business and industry in a hundred ways; that the use of electricity could be increased 400 per cent while population grew only 18 per cent; and that the public's pride in war and armaments could be abated so quickly. But the fact is that these and countless other accomplishments have either been consummated or made certain of early realization.

Will tomorrow be a similar era of dreams come true? In what directions will our advances be made? What radical changes will take place in the handling of crime, education, city development, antiquated legal machinery, unnecessary noises, conservation of resources, safety of life, and particularly in the matter of new industries which must be speedily created to dispel unemployment?

The Dreamers Are the Ones Who Profit Most

Those who are first able to discover a new trend and then capitalize it, are the ones who generally profit most from their efforts in business. The whole history of industry shows an unending series of costly mistakes on the part of leaders respecting the permanent importance of changes in public desires or tendencies.

The campaign against noise is gaining strength. Before long this fight to remove needless din will get sufficient popular support to inaugurate remedial legislation. How many existing practices will be seriously affected? We are coming to a shorter working week, to the use of the talkies in the wide field of commerce, to the beautifying of our cities and highways, and to the production of dozens of new foods and new metals. How will these things affect various lines of enterprise? Such are the questions that each person in business today must be continually asking himself.

The coal industry faces disaster as a result of its unfortunate and long-continued complacency in the face of serious threats to its prosperity. The mine owners did practically nothing to safeguard their markets at the moment when it first became evident that one pound of coal would soon be doing the work of two pounds. The coal operators are still hopefully waiting for the curve of consumption to again turn upward.

Right now our railroads are not enjoying a growth comparable with the average growth of the country. Highway and pipe-line transport of merchandise and fuel are bringing the carriers increased competition. The proposed rapid opening of new airways and waterways points to a further serious diversion of railway traffic. All of which presents the managements of our transportation systems with an urgent problem.

This same line of thought touches every department of American industry. Increasing the life of rubber tires made it necessary to find new uses for rubber. The success that has attended the introduction of talking pictures is causing the owners of legitimate theaters and the producers of plays to rapidly revise their estimates of this new competition. The musicians have ceased to take lightly the idea of canned music. The natural and artificial ice companies have at last awakened to the true import of the mechanical refrigerator.

Dozens of products that were either grown or mined a few years ago have been largely supplanted by synthetic materials. In every such case, larger losses have resulted to business than would have come if there had been a greater show of foresight and ingenuity in meeting changed conditions. New beliefs and new ideas, fostered by only a few people, soon grow into mass movements that sweep aside all opposition.

Someone says, "Let's beautify our environment." If the idea takes hold, we soon find a growing sentiment that may result in the arbitrary abolishment of billboards and other so-called blots on the landscape. Experiments in a chemical laboratory show that certain foods contain good vitamins or bad acids, and right away the profits of a lot of companies go up or down in proportion to the degree of change that is brought about in the public's eating habits.

Looking ahead, what can we see? Among other things are plain evidences of definite movements toward the universal adoption of rustless metals, smokeless fuels, humidified indoor air, engines that will burn crude oil directly, centralized heating and cooling systems, insulated buildings, quantity cooking in central kitchens, light that is colder and contains a goodly proportion of vital invisible rays, automatic merchandising machines, synthetic products to eat and wear, and quickly-frozen foods which can be stored or transported long distances without loss of value. People working in opposition to these and other positive trends must carefully watch their step.

Most Radical Changes Are Yet to Come

Coming changes will be more revolutionary than ever before. We approach low-cost houses that will be manufactured in parts, so that these parts may be quickly assembled at any point. A crew of men specializing in this work will put a house together in three or four days. Housekeeping equipment, even in the homes of the laboring classes, will be largely automatic. Motors will do nearly all the drudgery at the bid of buttons and levers.

Almost before we know it buildings will go up resembling overgrown monuments of solid blocks of granite. People living and working in these windowless structures will be free of noise, dirt and the effects of a hot summer sun. They will have only a lingering memory that the old-time ventilation from windows was merely draft, and will very soon feel the beneficial effects of living and working under a system of artificial illumination rich in ultra-violet rays.

In windowless homes, offices and factories there will be no disturbance of the thermal equilibrium of the indoor air. There will be less waste of fuel and a general elimination of noise and distraction. Air properly treated will be delivered in every room by ventilating equipment which will largely remove germs and dust particles.

If natural sunlight is used at all, it will come from condensers outside which will receive and reflect the light from the sky through transmission lenses to diffusing reflectors within the room, thereby affording each interior a light of uniform brilliancy. In this plan it will be easily possible to filter out the red heat rays from the sun's light in warm

(*Concluded on page 48*)

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EDITORIAL

Structural Work and the Job Welder

NOTHING could be more natural than that the job welding contractor should want to try his hand at structural steel work. A number of them have already had remarkable success on good-sized jobs which were sublet to them by construction firms who did not have the organization necessary to carry out the welding part of these projects. It is a line of business which certainly ought to increase rapidly during the next few years. It is becoming well known that welding of structural steel promises to reduce the erection cost of many types of small buildings, and there are still very few structural steel fabricators who are sufficiently familiar with welding to do a satisfactory job without outside help. The probability is that in the course of time, the fabricators will gradually become more and more familiar with welding until they feel confident in their ability to install equipment and build up welding departments so as to do their own welding instead of subletting it. The welding contractor may not like the idea of looking forward to losing this business, but that should not prevent his from anticipating what is likely to happen and making his plans accordingly. He can build up a good volume of business by cultivating the acquaintance of structural engineers and showing them how they can use welding to advantage, and certainly there is something to be gained from even a temporary volume of such special work. As a matter of fact, structural welding should provide work for a first-class commercial welder for a number of years before the volume shows signs of decreasing. Once a business has been built up in this line, it should never disappear entirely; and while it is at the peak, there will probably be developments in the industry which will point the way to other kinds of work to take its place. There is a tendency on the part of welding contractors to resent these conditions and to assume that what has once been their job should always be their job. This might be true if all industry were at a standstill. Instead of this, industry is constantly changing its methods, its policies and its processes. The largest industries in the country are forced to make changes in their plans, in their products, and in their sales methods in order to keep up with progress and to maintain their growth. Those who get ahead are the ones who take advantage of present opportunities and make plans for the future when these opportunities will no longer exist. There is much opportunity in the structural field for a capable welding organization. This opportunity must be capitalized now while the greatest need for the services of welding experts exists.

The Real Purpose of Redesign

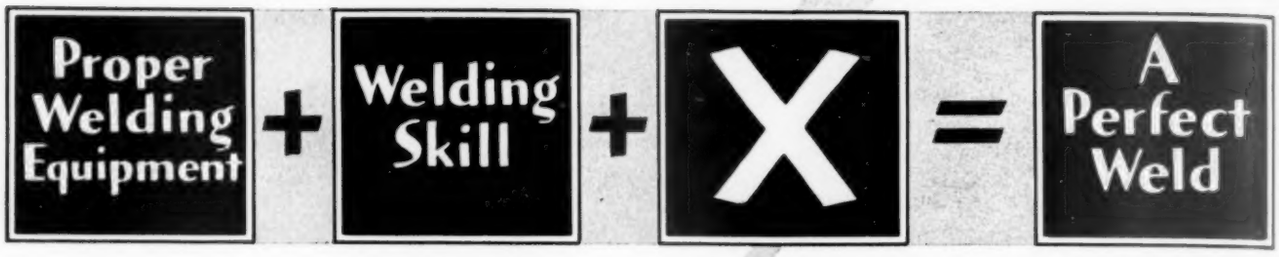
PRACTICALLY all of the new uses for welding involve redesign engineering. Redesign is, of course, very often necessary in order to make a job weldable; but this is not the whole purpose of redesign. Fundamentally, the purpose is to secure some very desirable economy, such as economy in the fabrication cost of a product. An example of redesign engineering which promises to become very far-reaching in its effects on the efficiency of operations in one of our large industries is the fabrication of thin-wall pipe by welding. In its present stage of development, this use of welding has lowered the cost of pipe line construction to the point where pipe lines appear to be used for projects which were not anticipated a few years ago. The success of this development has been so spectacular as to justify calling attention to it because it illustrates a fundamental principle so beautifully. Although it is usually necessary to produce new designs in order to use welding to the best advantage, the real important thing is that the welding process makes possible changes in fabrication methods which result in more economical production at no sacrifice in quality, and with a good possibility of improving the quality. In other words, it is an opportunity rather than an obligation.

Welded Design Changes Living Standards

SEVERAL years have passed since it was first pointed out in these columns that welding opportunities were presented by the industrial tendency toward redesign engineering. In this short time, there have been several extremely interesting developments in industry which have borne out this prophecy. One of the most familiar and far-reaching developments is the automatic household ice machine. Many thousands of homes are enjoying new comforts, relieved of a few items of housekeeping labor and adding new dishes to the menu because welding has made it possible to produce the automatic household refrigerator at a price within reach of the average well-to-do family. There is another feat of redesign engineering which promises to have equally important effects. This is the manufacture of thin-walled pipe by rolling and welding. This is virtually a new kind of pipe. It makes possible such enormous reductions in the cost of pipe-line construction that work is under way on the construction of natural-gas pipe lines from Texas to Illinois and Indiana. All along the lines, large cities are considering with great interest the possibility of using natural gas as a fuel at a cost which compares favorably with the cost of coal or oil. It will take some time to discover what the possibilities really are for house-heating with natural gas in the regions served by such a project. Both the householder and the industrial plant manager are aware of the possibilities of reduced labor cost and increased convenience which may be in store for them in the future. Thus, another change in living standards is at least partly promised by a method of making pipe which involves the use of welding. There are obviously great possibilities involved in finding new uses for these welding processes. The man who thinks in terms of finding more new uses is more than a dreamer. He is a builder.

Bigger and Higher

ALMOST every month announcement is made of some new welded building, and in some months two or three such buildings are announced to the reading public. Today such items are news; but some day they will not be broadcast, for such construction will be taken for granted and will have lost its news value as far as the general public is concerned. Even today welding news has lost some of its former spice to the man in the street. Still he can be cajoled into reading it if some new angle is involved. For example, when a new welded building is announced as being higher than any steel structure heretofore put together by welding, a new element of news enters and interest is aroused. Announcements of that kind are being made, and they will be made at frequent intervals for some time to come, as constructors of welded buildings vie with each other to build the "highest" welded building. All of this is for the general good of welding, but reputable builders hesitate to erect such buildings as will require extra-great stresses in welds compared with stresses in existing welds in other buildings. Welded buildings keep rising higher, but the industry is playing safe.



The unknown quantity X is the chemical and physical characteristics of the welding wire . . .

The only way to complete your equation is to know that your welding wire and electrodes are *uniform* and that they are free from detrimental inclusions.

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WELDING WIRE AND ELECTRODES

Welded Design in Boat Construction

All-Welded 60-Ft. Vessel, With Leak-Proof Bulkheads, Presented Unusual Problems in Construction

By J. G. Brown Jr.*

A BOAT built for bulk deliveries of refined oils to Chesapeake Bay Stations was recently fabricated by arc welding. The vessel is 60 ft. long, with a 15-ft. beam and a 6-ft. draft when loaded. Fig. 1 shows the plan and elevation views of the vessel.

The keel was laid on December 10, 1929, in the boiler shop of the Philadelphia plant of The Atlantic Refining Co.

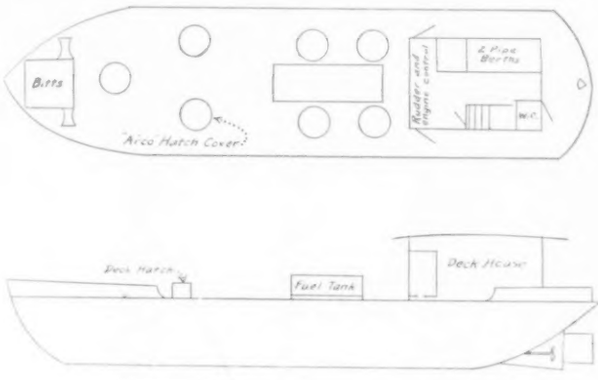


Fig. 1. Plan and Elevation Drawings of Welded Boat.

on especially prepared cribbing. The keel plate, $\frac{5}{16}$ in. by 37 in. wide by 59 ft. 8¼ in. long, was laid in five pieces, which were joined with four inside butt straps of $\frac{5}{16}$-in. plate, 3½ in. wide, welded at both sides with a $\frac{7}{16}$-in. bead. The ends of the keel plates on the outside were bevelled to a 45-deg. angle with a ⅛-in. opening at the butt-strap side, as shown

*General Welding Foreman, The Atlantic Refining Co.

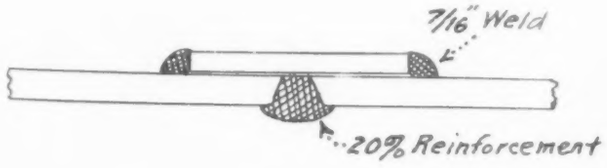


Fig. 2. Method of Joining Keel Plates.

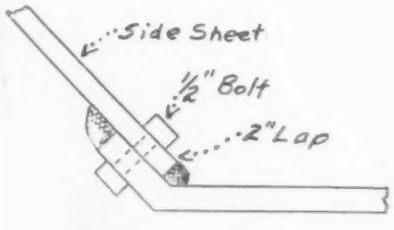
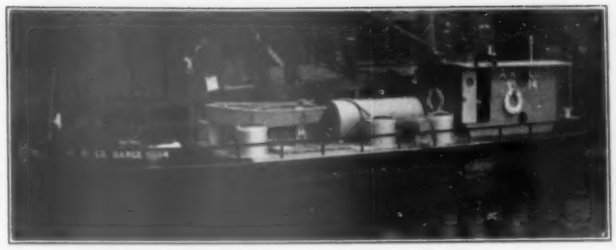


Fig. 3. Joining Bottom Sheet to Keel by Bolting and Welding.



in Fig. 2. Four ½-in. bolts held each of these four butt straps in place. The only welding done at this stage was a bead 6 in. long on each side of the butt straps at the point where the longitudinal bulkheads were to be located.

Joining the Bottom Sheets to the Keel

On December 15th, the center bottom sheets were placed and bolted to the keel. These sheets were held in position by wood frames until such time as they became self-supporting by being tack welded to the transverse bulkheads. These bottom sheets, $\frac{5}{16}$ in. by 6 ft. by 8 ft., were sheared and ½-in. holes punched at 24-in. centers, no unusual precaution being taken to obtain a perfect fit. Planing of these sheets was thought unnecessary for welded construction. This arrangement of ½-in. holes spaced on 24-in. centers for bolting up, was used on all joints on this boat. Fig. 3 shows the joining of the bottom sheet to the keel by bolting and welding.

During the time these bottom sheets were being prepared, the first transverse bulkhead was set up on an I-beam frame and clamped down to hold it as straight as possible during and after welding. The frame consisted of six 4-in. I-beams spaced 2 ft. 4 in. apart, these being laid across the railroad tracks in the boiler shop, leveled up, and then welded to the rail, as shown in Fig. 4. On top of these I-beams the bulkhead plate, sheared to the required size, was laid and a 3x3-in. T-bar, which ran entirely around its outer edge, was clamped to the frame with C-clamps spaced 18 in. apart. One side of the plate, when secured in this manner,

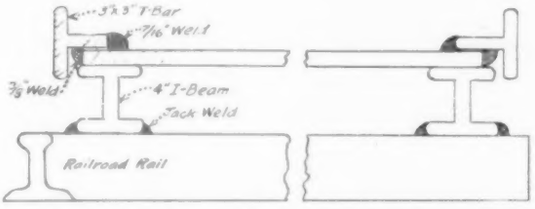


Fig. 4. Method of Laying Out and Welding Bulkheads in the Shop.

was sandblasted to remove all rust and scale. A ¼-in. bead was then laid to secure the T-bar to the plate. On completion of this bead, a caulking hammer was used to pack the bead and remove the oxide, and a second bead was then laid over the first to make a $\frac{7}{16}$-in. finish weld, as shown in Fig. 4. The bulkhead was then turned over and the operation repeated, the only difference being that a single ⅜-in. bead was applied to this side. The bulkhead stiffeners, four in number, of ⅜ x4-in. bar stock, were then welded into place.

Bulkhead Presents a Problem in Warpage

On completion of this bulkhead, it was found that considerable warpage had taken place and that the bulkhead was very rigid, so on the remaining bulkheads a ⅜-in. single bead only was applied on this jig, the double-bead welding on the opposite side being finished after the bulkheads had been tacked into position in the boat. While getting about the same warpage by this method, the bulkhead was

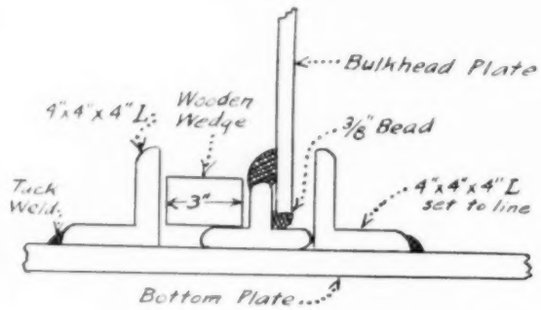


Fig. 5. Lining Up Bulkhead for Welding.

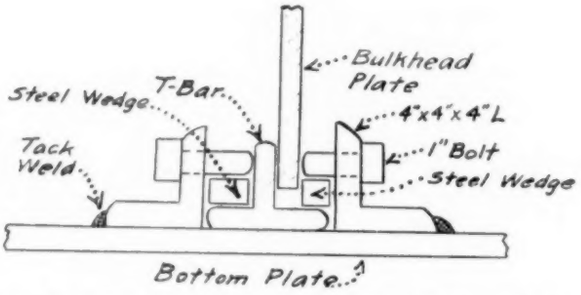


Fig. 6. Forcing Bulkhead T-Bar Against Bottom Plate for Welding.

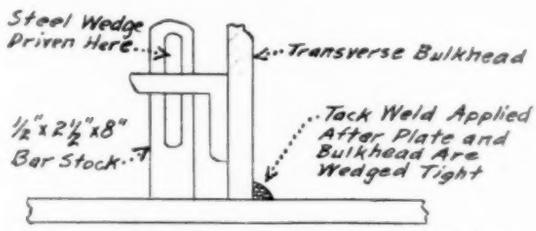

Steel Wedge Driven Here
Transverse Bulkhead
1/2" x 2 1/2" x 8" Bar Stock
Tack Weld Applied After Plate and Bulkhead Are Wedged Tight

Fig. 7. Method of Clamping Transverse Bulkhead Against Plate.

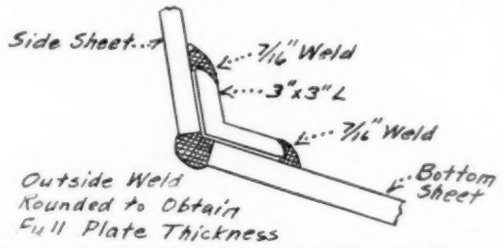


Fig. 8. Design of Joint Between Side Sheet and Bottom Sheet.

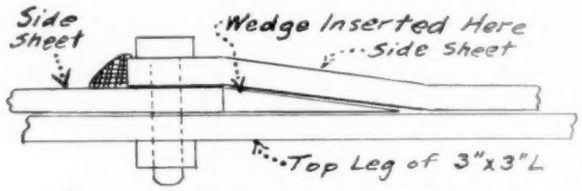


Fig. 9. Bolted and Welded Lap Joint in Side Sheet.

very much less rigid and consequently less difficult to put into position in the boat.

On December 17th, the first transverse bulkhead was set in place. This bulkhead was lined up by welding four equally spaced angle-iron lugs, 4 in. long, cut from a 4x4-in. angle, to each bottom plate, and two similar lugs to the keel plate. These lugs were carefully set up to a chalk line struck on the plates which marked the outside of the bulkhead T-bar. On the opposite side of the bulkhead similar angle-iron lugs were welded to the bottom plates 1½ in. from the outside line of the T-bar. A 3-in. wooden wedge was then driven between the second set of lugs and the face of the bulkhead, which wedged the bulkhead up tight to the first set of angles which were in line. This method is illustrated in Fig. 5.

To bring the bulkhead up tight to the bottom and keel plates, an additional 4x4-in. angle-iron lug, 4 in. long, was welded to the bottom or keel plates wherever there was a separation between the plate and the T-bar of the bulkhead. This lug had a 1-in. hole in the vertical side through which a 1x2-in. bolt was placed and a steel wedge driven between the bolt and the flange of the T-bar, forcing the T-bar and plate together. This method, shown in Fig. 6, was found to be quicker and more efficient than the use of bolts. All of the above-mentioned lugs were removed after the plates were tacked.

Welding the Bulkheads in Place

When the bulkhead was wedged into place, it was tack-welded to hold it in line, with a ¼-in. bead, 3 in. long, at 1-ft. intervals. After tacking this bulkhead into place, the longitudinal bulkhead, which fits up to the center of the transverse bulkhead, was placed on the center line of the keel, centered by the method described in Fig. 5, but clamped down by the method shown in Fig. 7. This bulkhead was not bounded by any T-bar. To make it tight to the keel plate, a 4x4-in. angle iron, 4 in. long, was welded to the bulkhead, toe down, with 1-in. clearance from the toe of the angle iron to the bottom of the bulkhead. The opposite leg of this angle iron had a ⅝x3-in. slot cut in it, through which a piece of ½x2½x8-in. bar stock was inserted. The bottom of this bar iron was also welded to the keel plate. A steel wedge was then driven through the ½x5-in. slot in the bar iron over the top of the angle, thus pulling the bulkhead and keel together.

Each of the other transverse and longitudinal bulkheads was put into place by the above-described method and tack-welded. Then the side sheets were fitted up to the bottom. For this joint, a 3x3-in. angle iron was bolted inside the bottom sheet, and the side sheet bolted to the opposite leg of the angle, ½-in. bolts on 24-in. centers being used. A typical joint is shown in Fig. 8. No seams were welded until the bulkheads, bottom sheets, and side sheets were fitted up completely, and then wedges, as shown in Fig. 9, were inserted at points where the sheets lapped.

Welding was then started in the tanks formed by the bulkheads and side and bottom sheets and proceeded in the following manner:

Preventing Expansion Buckles by Step-Back Welding

All seams were sandblasted, after which a ¼-in. bead was laid by the step-back method. This method consisted of welding for a length of 6 in. then skipping 3 ft. of seam, and again applying 6 in. of weld, until the seam has been completely welded. Welding was performed by this method to keep expansion buckles out of the plate. When first bead had been completed, each seam was rough-tooled with a pneumatic hammer to free the surface of oxides and to relieve some of the locked strains set up by weld expansion. Next the ⅜-in. finish bead was applied. It was found by experiment that the step-back method was also better for this second bead from the standpoint of sheet distortion.

On completion of the seam welding in the tank compartments, the vertical stiffener pieces of ⅜x4-in. bar stock were tacked into place on 24-in. centers along the side of the bottom sheets. It was found, while applying these stiffeners, that despite extreme caution there was some distor-

tion and the stiffeners had to be pulled into place, after which they were skip-welded on both sides, 3 in. of ⅜-in. bead being applied and a like space skipped. This weld was sufficiently high in tensile strength; and as liquid tightness was not essential on this joint, no continuous welds were run except around the ends of the stiffeners. Where the bottom stiffeners tied into the side-sheet stiffeners and where the side-sheet stiffeners tied into the deck stiffeners, continuous ⅜-in. welds were used on both sides to distribute strains from any single plate to the surrounding plates. Bare electrode of $\frac{5}{32}$ in. was used throughout the whole job.

To pull the stiffeners into place, two lugs were made from a piece of ½x3-in. bar stock, with a ½x4-in. slotted hole set in 1 in. from the end of the bar, each lug being 8 in. long. The long end of each lug was welded to the side sheet, one lug being located on each side of the stiffener. A wedge was then driven through the slotted holes, forcing the stiffener and the plate together. This method is illustrated in Fig. 10.

At the forward end of the boat, the keel plate was notched out at its center 1¼ in. wide for a distance of 32 in. to tie in to the stem post. This stem post, formed of 1-in. by 5-in. by 15-ft. bar stock, was forged to the required shape and tacked into place at the keel, after which the bottom and side sheets, rolled and forged to the required shape, were joined to it with butt welds. A ¾-in. bead on both sides of the sheet was used at this point to give added strength. This post is also braced and tied to the side and bottom sheets with knee braces as well as being tied to the forward transverse bulkhead with a continuous 12.7-lb. plate. The stem post and bracing are shown in Fig. 11.

Engine Base Constructed of Vertical Plates

Next the engine-room compartment was finished and the engine base, shown in Fig. 12, was continuously welded on all joints. This base was made from two longitudinal plates ⅜ in. thick and 11 ft. 1½ in. long, crossed by five transverse plates of the same thickness. These plates were slotted at their points of intersection.

Another particular piece of work in this compartment was the stuffingbox sleeve, which carries the screw shaft through the keel plate. This sleeve had to be held to a tolerance of 0.010 in., which was accomplished by keeping the sleeve and plate cooled with water on the opposite side while welding was in progress.

On completion of the hull welding, deck stiffeners, similar to the vertical stiffeners already described, were installed and the deck plates tack-welded into place over them. The deck was laid with sheets 16 ft. in length, running longitudinally, three courses wide. The two outside sections, 5 ft. 9 in. by 16 ft. were laid on top of the angle iron, which tied the deck and side sheets together, ½ in. from the extreme edge. This was one of the most important items of welding encountered on the whole job, because the tanks had to be sealed at the deck side just as securely as at the bottom and sides, and this work had to be performed in the overhead position. The center section of the deck, 40 in. wide by 16 ft. long, was lapped on top of the two outside sections and welded inside and out, as shown in Fig. 13.

Welding the Crew Quarters

While this work was in progress, the deck house was set up on a plate foundation on the boiler-shop floor. This deck house, 7x13x7 ft. high, was made of $\frac{3}{16}$-in. plate. Each plate joint, which was butted to the one adjoining, was backed up with a 1½x1½-in. T-bar to keep the plate from buckling and to stiffen the structure. The roof was of the same material, with a 2½x2½-in. angle around the outer edge. A 1½-in. pipe at each end of the after end formed down-spouts to drain water from the roof. In this house are the quarters for the crew of two men as well as the engine-control and steering-gear apparatus.

The fuel tank, which sets forward off the deck house (see Fig. 1), was made of $\frac{3}{16}$-in. plate, all welded and anchored to the deck on welded brackets.

The deck hatches, with which each tank is equipped, were made of $\frac{5}{16}$-in. plate, rolled to 33-in. diameter, with the side seam welded. A 2½x2½-in. angle rolled to the same diameter was fitted into one end to form the seat for the hatch cover casting. The opposite end of this ring was welded to the deck. The deck plan in Fig. 1 shows the location of these hatches.

The ½-in. holes on 24-in. centers used to bolt the sheet and deck plates together and hold them in line were stripped of bolts and countersunk from the outside, after which they

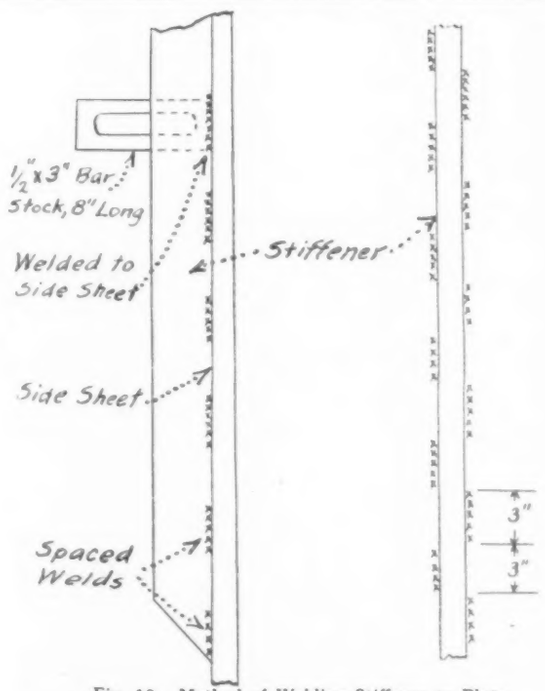


Fig. 10. Method of Welding Stiffener to Plate.

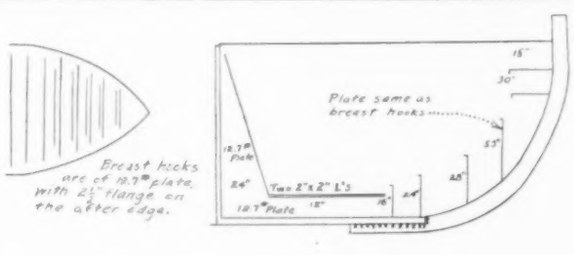


Fig. 11. Design of Stem Post and Bracing.

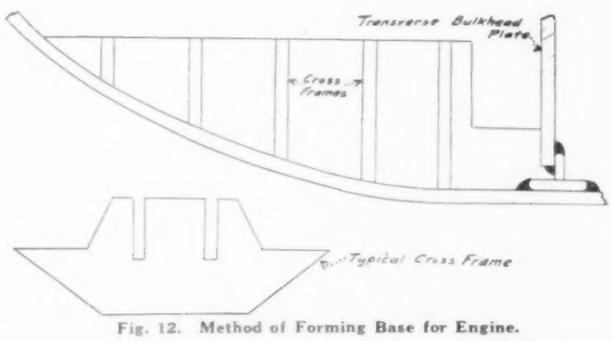


Fig. 12. Method of Forming Base for Engine.

were welded up solid, the outside being ground flush after welding. The inside was built up with a 50% reinforcement, as shown in Fig. 14.

With all the welding on the hull completed, the boat was shored up and water run into each of the tanks and compartments, in turn, to a point well above the light-load water-line. Each tank was emptied before the next one was filled so that each tank divisional bulkhead had a double test at this time. Only one leak, and that of pin-hole dimensions, was discovered at this time, which was taken up by peaning with a hand hammer.

On March 17th, this structure was lashed to the skid on which it was built with turnbuckles and transported on rollers one-half the distance to the point of launching. On

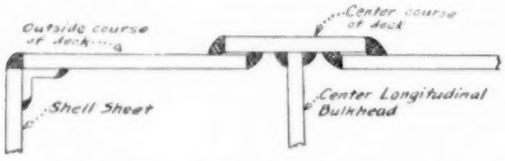


Fig. 13. Design of Center Section of Deck.

Fig. 14. Bolts Removed and Holes Welded Up Solid.

March 18th, it was moved to the water front; and on the following day, a 120-ton railroad crane picked it up in wire slings and launched it in the Schuylkill River.

After launching, the deck house, deck fittings, engine-room fittings and tank equipment were installed, after which the second coat of paint was applied. Trials were run on March 25th. No leakage was detected.

This boat is powered with a 45-hp. Diesel engine, which performed creditably on the trials.

Less Weight, Less Cost, More Rigid Structure

The outstanding factors in this type of construction are:

A considerable reduction in gross weight was realized for the same cargo capacity, due to the elimination of rivets.

No greater amount of time was consumed than that asked by shipyards for the same size of riveted job.

There were no leaks to take up, as there would be in riveted construction.

A higher tensile strength combined with a more rigid joint is obtained by welding than is possible with riveted construction.

The cost is considerably lower than for the same size of riveted boat.

FLUX COATINGS AID PROGRESS OF ARC WELDING

By C. J. Holslag, Chief Engineer,
Electric Arc Cutting and Welding Co., Newark, N. J.

The electric arc-welding process is a true metal-casting process and every metal founder knows that without the proper fluxes he would be helpless; in the small and concentrated type of casting known as welding the worker is benefited by fluxes to an even greater extent. Many people are beginning to realize this, and of the two types of electrodes used in electric-arc welding—bare and coated—the coated electrodes are coming more and more into general use in the United States and Canada.

These coated electrodes may be divided into two general classes—slag-coated and flux-coated. Of the slag-coated electrodes there are two kinds. One type uses a volatile covering, generally organic, such as flour, wood-pulp, sawdust, etc.; the other uses an inorganic covering, generally silica, such as sand, marble-dust, or ashes. The former is an attempt to obviate the "slag" which is liable to cause trouble in succeeding layers of deposits; but for work where a very heavy coating is suitable, the best way is to welcome the slag and make the deposit in one course, or use the extreme care necessary where one course is not practicable.

The problem confronting every welder, of course, is to prevent as far as possible the partial combination of the molten metal with oxygen and nitrogen; in other words, to prevent the formation of metallic oxides and nitrides. Such compounds are detrimental to the success of welding, as they form masses which become entrapped in the weld, creating weak and imperfect sections. The use of anything which will avoid the formation of such masses is very advantageous to the welder. This may be done by shielding the molten metal, as far as is possible, from contact with the air, and then by the disposal of such oxides and nitrides as have been unavoidably formed. If the active weld can be surrounded with an inert mass that will melt at the temperature of the arc but will not combine with the air, the molten metal then will not come in contact with the air and oxidation will be reduced.

As compared with bare wire, the slag-coated electrode accomplishes this purpose, but has a great disadvantage in that the slag may become entrapped in the weld. In protecting the deposit from microscopic impurities, actual deposits of slag may be found in the weld, with consequent weakening of sections. Therefore, although the slag-coated electrode makes arc welding easier, greater care must be taken to avoid the inclusion of slag in the weld, and considerable chipping is required for successive layer work.

The flux-coated electrode, with its "hit and get away" action, does not preheat nor does it warp, and it is this advantage in metallic arc welding which has allowed the industry to assume the proportions it already has. It appears to the writer that in this connection the surface hardly has been scratched as yet and that future progress will be along the same lines as the advances of the past, namely with the use of thinly flux-coated electrodes.

A great modern development of the arc is its use in the welding of cast iron; and in this, the use of the flux is almost indispensable; in fact, most of the improvements in cast-iron welding have been made possible by the use of flux-coated electrodes. The flux, being a carboniferous compound, becomes active under the heat of the arc and tends to keep the weld soft. In addition, the flux usually contains other compounds which prevent oxidation and tend to keep the weld molten. In studding and other special work, the flux-coated steel electrode is of great assistance and it is possible to use a specially developed flux-coated electrode made of cast iron.

On some electrodes, the flux coating is thick and heavy, on others thin; still others are half-coated, so that the arc will be encouraged ahead when the electrode is used with the bare side advancing. This last-mentioned type is ideal also for automatic welding, and this branch of the art practically requires flux-coated wire to realize good results. For cutting, an excess of oxidation is desirable; therefore, a heavy coating may be used to assist the reaction; but for ordinary welding, a very heavy flux coating is not usually necessary. However, the degree of coating may be in accordance with the particular work in view.

In short, for a multitude of uses the flux-coated electrode has been proved to be the best, and tests made by scientific bodies confirm this. The writer feels that the progress of the arc depends upon proceeding along the same lines; and if this is done, the future of arc welding should surpass its past.

Welding in Glider Construction

The Oxy-Acetylene Torch Is Used for Welding Jigs for Assembling Fuselages and Tail Surfaces, and for Welding the Component Parts of the Glider Itself

By J. C. Coyle

PIONEERS in aviation were greatly aided in their experiments by glider flights. Today, aside from its growing popularity as a sport, "gliding" is coming into much favor as a means of acquiring a considerable amount of the training required in operating airplanes. Clubs are being formed here and there for the purchase and operation of gliders. Twenty or more persons may for a few dollars each become joint owners of one, giving each a chance at learning to operate it. Danger of injury during practice flights is slight, because the flying and landing speeds are so low and the glider so light.

Four years in the manufacture of the Eaglerock airplane, with one of the largest and best equipped factories on the continent, makes the Alexander Aircraft Co., of Colorado Springs, Colo., well fitted for production of gliders for training purposes, which is its latest activity. Being designed and constructed for flight in the light air of the Rocky Mountain region, the Alexander glider is all the more easily operated at points nearer sea level. The total weight is approximately 210 lb., wing span 36 ft., wing cord 5.5 ft., and wing area 198 sq. ft. The fuselage is of tough steel tubing, ranging from ½ to 1 in. in size, with all joints welded. The wings are of spruce and plywod, with drag

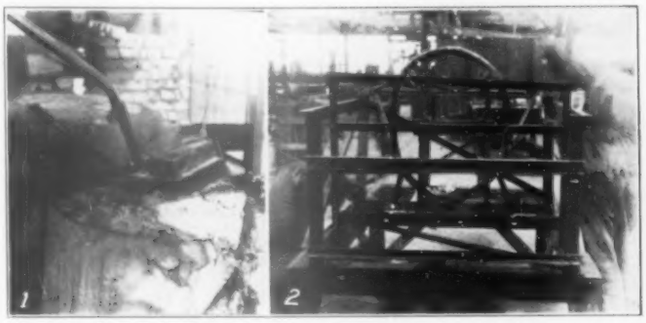


Fig. 1. Removing Wheel End of Axle From Brazing Pot.
Fig. 2. Jig for Welding Engine Mounts.

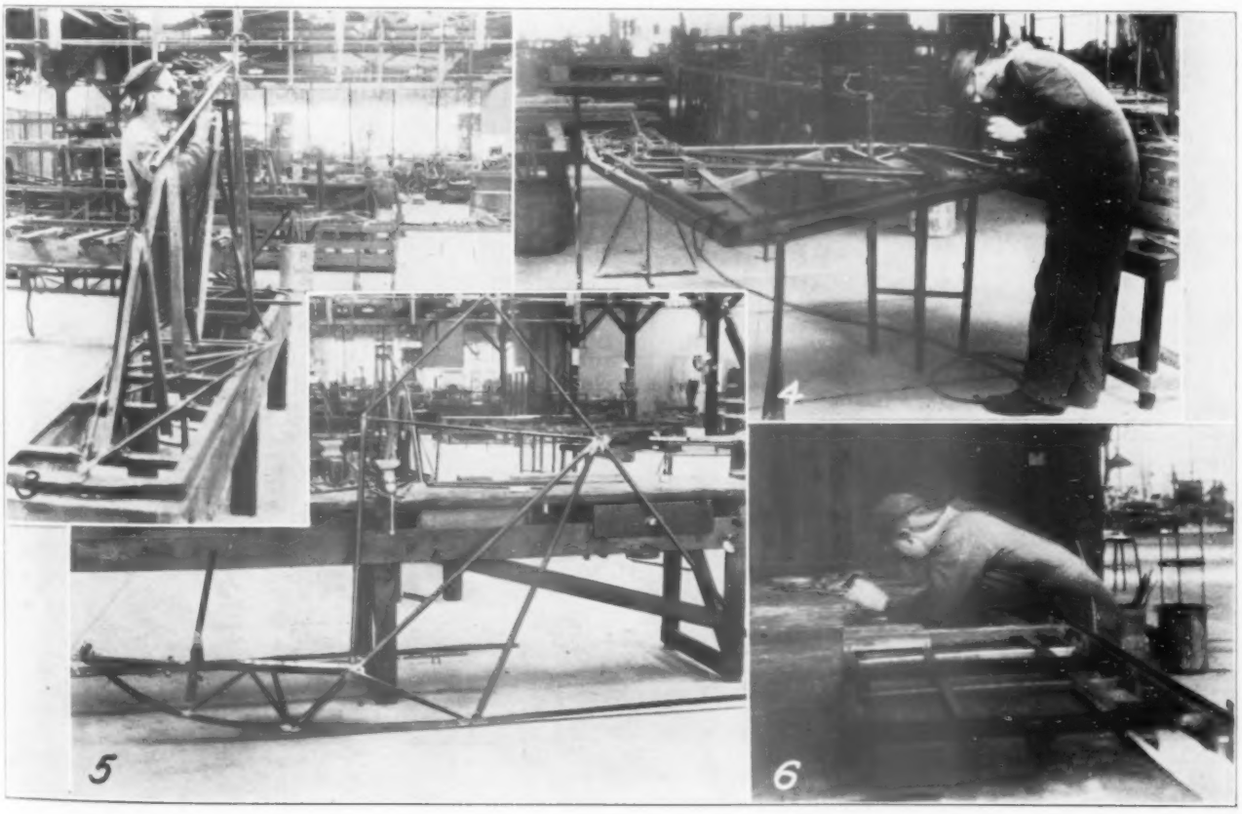
wires of music wire covered with fabric and coated with nitro-cellulose.

Interesting Production Methods

As in the manufacture of the Eaglerock airplane, production of gliders on a commercial scale has necessitated the use of numerous original methods and jigs of interest to welders. Tubing for the fuselage is first cut to the various lengths required on a power cold saw. It is then assembled in jigs of angle iron for welding. The fuselage is in two sections, to facilitate transportation, and may be put together in a few minutes by bolting.

The jig for welding the front section of the fuselage is made of 1½-in. angles, cut and bent into irregular shape

Fig. 3. Jig for Welding Rear Fuselage Section.
Fig. 4. Assembly Jig for Front Fuselage Section.
Fig. 5. Close-Up View of Front Fuselage Section of Alexander Glider.
Fig. 6. Jig for Welding Tail Surfaces.



to match that of the section. All joints in the jig are made with the torch. Over thirty pairs of short angle sections are bolted to the top of the jig in such positions as to hold the different pieces of tubing in proper relation to one another while being welded. The 1-in.-square tube forming the bottom of the section is held in the jig by flat keys inserted in slots milled in the top of the clamping units. For the smaller tubing keys are not required. The jig is supported on light trestles fabricated from tubing, so it may be moved about easily if desired. This fuselage section has over 40 separate welds.

The rear fuselage section is constructed of somewhat lighter tubing than the front, and is assembled upside down in an angle-iron jig mounted on a low bench. The jig is 19 in. wide and 10 ft. 2 in. long. There are eight cross braces at the bottom, of 1½-in. angles, and three vertical supports for the bottom tube of the fuselage, which also are of angle iron. Parts of the fuselage section are welded in one at a time until the structure is completed.

Assembling and Welding Tail Surfaces

One jig, also constructed of angles and channels, serves in the fabrication of all four tail surfaces of the glider. One side, and the five cross bars of the jig, are formed of inverted 1x2-in. channels. A 1½-in. angle is bolted to the top of the long channel, and has several short sections of ⅛-in. strap welded to its inner side to hold the tubing away from the jig at the weld joints. The opposite side of the tail-surface tubing fits against a short section of angle bolted to each cross bar of the jig. Three angles run lengthwise of the jig, one 1½-in. angle for the trail edge, one 1¼x1-in. and one 1x1-in. angle. The two inner angles of the jig have numerous square and diagonal slots cut in the edge, to accommodate the various metal members of the different tail surfaces. The leading edge of the tail surfaces is of tubing, and the ribs and trail edges are of black iron. The latter parts are fashioned partly on a punch press and partly on a brake in the sheet-metal department of the factory.

In welding tail surfaces the jig is turned over after the top side is finished, so the other side of the construction may be welded. The metal parts are then ready for dipping in Lionoil. The fuselages, tail surfaces, and wings are conveyed on an overhead track to the Lionoil vat, which is in a building at some distance from the main plant. When dry, they are covered with fabric and the parts are then taken to the doping department, also some distance from the main building, where they are coated with nitro-cellulose and returned on an overhead trolley. The glider is then ready for assembly or shipping. Jigs are also employed in the construction of airplane fuselages.

Finishing the Axles

Of particular interest are the methods used in finishing axles for the Eaglerock, which are of 1½-in. tubing. First, an 8-in. reinforcing sleeve of 1⅛-in. tubing is forced into the wheel end of the axle. The axle is then heated with a torch at the reinforced portion and bent to the proper shape in a bending jig. At the opposite end of the axle the hinge is applied by turning down a section to slip inside the axle, then drilling and riveting it.

A quantity of the axles are then taken to the drip brazing department, where a collar fitting is slipped over the wheel end and tack welded in place. For this purpose the axle end is inclosed in a special welding jig, consisting of a 1x4x7-in. block of steel, with a 7-in. section of hollow tubing ½ in. thick inserted through the center to receive the axle. An inch-square bar secured to this tubing by two set screws projects beyond the end of the tube and fits into one fork of the collar as the axle is inserted into the tube. This procedure holds the collar in exactly the right position until it is electrically tack welded. Each end of the axle is next dipped in a pot of molten brass, with flux added. When at a proper degree of heat, it is removed, adhering particles of surplus brass quickly brushed off, and the piece immersed in oil until cool.

The glaze is then removed from a portion of the bend in the axle, and the temper is drawn with an acetylene torch until the proper color shows. The axles are returned to the machine shop, where the hole in the hinge is reamed, and the ends chamfered with a fly cutter on a drill press. The collar fittings on the wheel end are milled out with a high-speed cutter. The finished axles are then stacked in a mill truck for delivery to the assembly department.

Engine mounts for Eaglerock planes are fabricated separately from the rest of the fuselage in a square jig of 1x2-in. channels and 1x1-in. and 1½x1-in. angles. Members used across the middle of the jig are sometimes loose, being held in place for different jobs by metal clamps, and the tubing for the mount being held in turn by other clamps. Mounts are assembled and welded a section at a time. Four bolts hold the mount and motor to the fuselage of the plane when assembled.

MANIPULATION TEST CHART REDUCES COST OF GAS-WELDING INSTRUCTION

The suggestion is often made in connection with welding instruction that it is well to have gas-welding students do some preliminary practice work with the unlighted torch in order to develop the necessary motions without consuming gases. About three years ago, an instructor in a welding school developed a practice chart to serve as an actual test of the student's ability to give the torch and rod a uniform movement. The test charts provide direction lines for welds in two directions with markings to indicate the points which the torch tip should touch on each side of the line of weld. Similar guide lines were provided for checking the motion of the welding rod and also for the combination of the welding rod and torch. These test charts were used by attaching a red pencil to the tip of the torch and a blue pencil to the tip of the welding rod, so that the paths of both the torch tip and the end of the welding rod were completely mapped on the test chart.

These charts have been used mainly for beginners, the students being required to show their proficiency in controlling the movement of the torch and rod with the unlighted torch before any work was done with the flame burning. After the tests were given to a prospective welder, the chart was marked "Uniform" or "Nonuniform" and the time required for making the test was noted. A "uniform" score allowed the pupil to proceed with his first actual welding, using two pieces of sheet metal without a rod, then a second set with the rod. It was noticed that a uniform showing on the test chart practically always indicated that the student would produce uniform work on his first test weld. Pupils who did not succeed in turning out a uniform job were required to make a second or third chart. If no improvement was shown after three trials with the chart—each followed by a trial weld—the pupil was not encouraged to continue welding, because it was decided that he did not have the necessary muscular control to master the torch and rod manipulation.

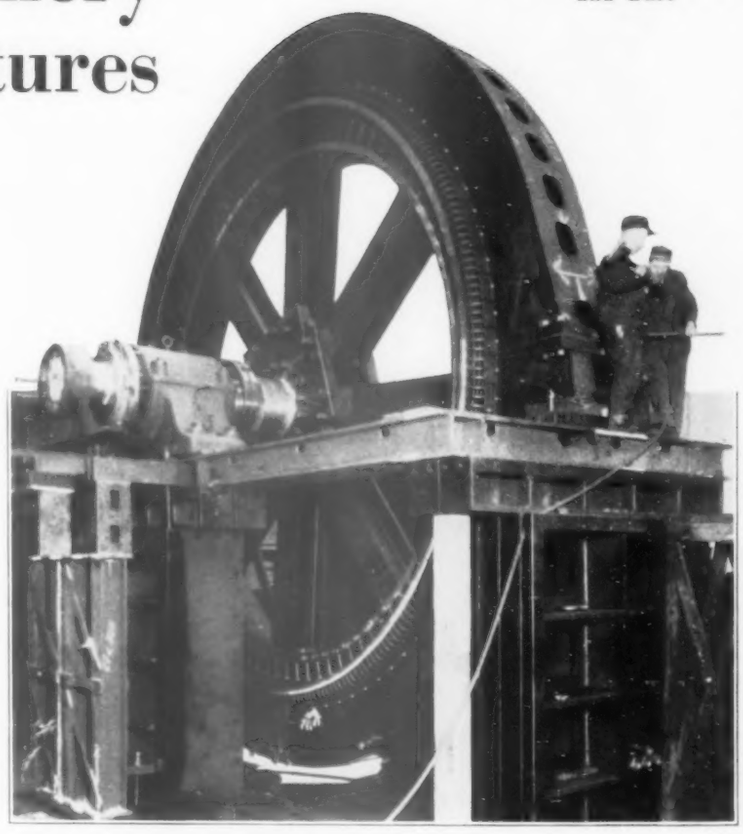
The publishers of *The Welding Engineer* have made arrangements to publish duplicates of the charts used by this welding instructor, and to supply them to welding schools and industrial plants who have their own training courses. The charts are self-explanatory and are accompanied by directions for making a practice welding torch out of small pieces of piping, together with an illustration showing the method of use.

Welding Machinery and Steel Structures

Electric Motors and Generators and Buildings and Bridges, Are Cited as Examples of Expanding Fields for the Welder's Art

By A. M. Candy*

5,000-Hp. Generator With Welded Frame and Base



THE use of arc welding as a means for fabricating various types of machinery has gone forward with great impetus during the past year and is also being realized on an extensive scale in the erection of buildings, bridges, and other steel structures.

The use of welded steel for building machinery has, to a very large extent, entirely replaced the use of castings in the plants of the larger electrical manufacturers. Welded construction is being used for the frames and bases of rotating electrical equipments from the smallest to the largest of generators and motors, running into capacities of 5,000 to 7,000 hp.

In the field of building construction the statistics available indicate that during the past year the number of welded buildings was increased by approximately 50% over the number existing up to that time. At present there is under construction in Los Angeles, Calif., a 15-story office building for the Southern California Edison Co., which will involve the use of approximately 3,600 tons of steel which is to be 75% welded. Also a 1,600-ton, 15-story office building is being built for the Boston Edison Co. at Boston, Mass., which will be quite an unusual structure in that the shop fabrication will be of riveted construction and the field erection will be of welded construction.

List of Welded Steel Structures for One Company

At various of the works of the Westinghouse Electric & Manufacturing Co. additions are now being made to the Research Laboratory, involving one structure approximately 200 ft. long, 50 ft. wide and three stories high, and a second building approximately 60 ft. square and three stories high, and a power house involving the use of a total of 360 tons of steel. At the Newark works of the same company there is under construction a 1,200-ton combination warehouse and service building approximately 400 ft. long by 100 ft. wide with a wing about 90 by 150 ft. At the East Pittsburgh works of the same company there is under construction a 2,000-ton office and engineering building, 220 ft. long and eleven stories high, which like the preceding building is to be entirely welded both for the shop fabrication and the field erection. There is also under construction an elevator parking garage 50 ft. by 50 ft. by 110 ft. high, involving 200 tons of steel, and ground is being broken for another building approximately 75 ft. wide by 400 ft. long which will involve approximately 400 tons of steel. These buildings, together with those which have already been constructed for the company, will make a total of 21 buildings either of all-welded design or having appreciable additions to them of all-welded construction, and involving a total tonnage of more than 7,000 tons of steel.

In over a hundred cities in the United States arc-welded buildings can be erected today either directly under provisions set forth in their building codes or by means of special permits from the city building departments.

The American Welding Society has issued a code for the construction of buildings by the welding process which has been adopted by some cities in the country and will undoubtedly be adopted by many more in the near future.

Some Recent Developments in Apparatus

Probably one of the outstanding developments in the design of electrical machinery for arc-welding work is that of the introduction of the Flex-Arc welder by the Westinghouse company, which is a unique departure in the design of single-operator machines. This machine, together with its new type of reactor, is so designed that the ease with which the electric arc can be started is considerably improved. Another decided advantage of this equipment is that the range which can be covered by a given machine is greatly extended so that the usefulness of the machine has been augmented.

In the field of automatic welding, a new type of automatic welding head known as the Weldomatic was recently introduced by the Westinghouse company. This machine, with its electrical control circuit, is designed so that the feed of the welding wire is continuous and is automatically varied in accordance with the rate of consumption of the wire or the rate of variation of distance between the welding nozzle and the work being welded. This is accomplished by means of a special electric circuit involving the control effect obtained from a potentiometer circuit.

Machines of these types are being used for the production of rear-axle housings for automobiles, for welding radius rods, torque tubes and drive shafts for cars, and in some cases on body construction work.

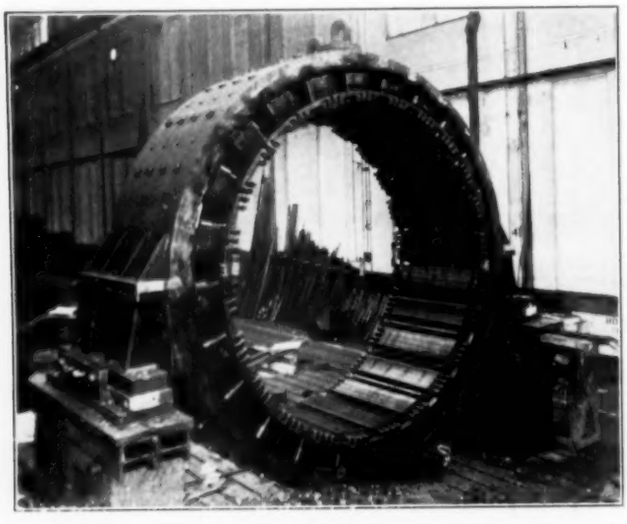
*Arc Welding Engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Undoubtedly in the future the manufacturers of machine tools and other equipment will make use of welding extensively in the production of their equipment, and undoubtedly in the field of building construction and bridge construction the use of welding will be found more extensively employed each year as it has been proven to be of very decided advantage for such work.

Briefly the advantages of welding are:

MACHINERY DESIGN:

1. Weights in many cases have been reduced as much as 50%.
2. Cost has been reduced due to elimination of pattern and core making and decreased machine work.
3. Simplified details of design have been made available by welded construction.
4. Homogeneity of metal is much more definite in rolled steel than in castings.
5. Delivery dates have been materially reduced due to elimination of pattern and core making requirements.
6. Pattern storage charges are eliminated.
7. Scrapping of castings due to sand holes or blow holes is eliminated where steel is used.
8. Repairs to welded machines made of steel are much less likely to be required and where required are much more dependable and less expensive than where castings of cast iron are used.



Electric Welding Has Found Favor With Builders of Large Electrical Equipment, as this 7,000 Hp. Machine Demonstrates

9. The capital investment required to produce welded machines is much lower than the capital investment required to produce castings and the necessary machine shop installation to machine the castings.

BUILDING AND BRIDGE CONSTRUCTION:

1. The weight of material in fabricated beams and girders can be reduced from 18% to as high as 25% by proper designing for arc welding instead of riveting.
2. No material need be removed from columns or tension members such as rivet holes; and therefore, in many cases, smaller members can be used for welded construction. This of course is of greatest importance in the case of tension members.
3. The weight of material for connections can be reduced from 50% to as high as 90% in some cases as compared with the requirements of riveted construction. This s particularly true in bridge construction work.
4. Absolute fixation of one member to another can be eadily obtained.
5. Continuity of lines of beams or girders can be readily obtained, permitting the use of smaller members in many cases. This likewise is probably of the greatest value in bridge construction and is not likely to be used very extensively in building construction work.
6. Much greater rigidity can be produced in a properly designed and welded structure.
7. Overlapping members can usually be completely sealed by weld metal, thereby excluding moisture and preventing corrosion between the adjoining surfaces.
8. A welded structure is much easier to paint than a riveted structure.
9. Changes in or additions to structures can be made in the field with great saving both in time and expense, regardless of whether the original structure was of riveted or welded design.
10. These changes simplify the more recent designs, and better architectural effects can be worked out in welded construction work.
11. Roof trusses can be constructed with much greater symmetry, thereby reducing secondary stresses at the panel point.
12. The welding process is practically noiseless, which is an asset in both shop fabrication and field erection work, particularly the latter.

WELDED FRAME, TRUSSES, ROOF, AND PIPING IN ALBANY BUILDING

Not only will the framework and roof trusses be welded in the new service building being erected by the New York Power & Light Corp., in Albany, but the roof itself and a large part of the steam piping will be installed by that method. The new building will be 375 ft. long and 198 ft. wide, partly single-story and partly multi-story in design. Foundations have already been laid, and it is hoped to complete the structure by September 1st.

About 700 tons of steel will be involved in the structure. It is estimated, in addition to many other advantages, that about 30 tons of steel will be saved by using the welding method.

One of the novelties in the construction of the building will be the installation of an all-steel roof of the steel deck type, completely welded. Sections of shaped steel resembling corrugated forms will be welded in interlocked positions and the whole covered with the usual type of roofing material. In addition, all steel steam pipe above 2 in. in diameter will be electrically welded.

Among the many advantages expected by the use of electric welding in the construction of this building are the quietness with which the operation takes place as opposed to riveting, the saving in weight, economy of design, and simplicity of operations.

The new service building will be used for storage, garage, work shop, laboratory, blacksmith and many other purposes. The offices of the engineering forces of the Albany engineering department of the New York Power & Light Corporation will also be there. It is expected that about 300 persons will be stationed in the building.

SUMMER MEETING OF C. G. M. A.

The Seaview Golf Club, Absecon, N. J., is the place set for the summer meeting of the Compressed Gas Manufacturers' Association, to be held June 19th to 21st, according to the Association's Bulletin. The program includes an open Executive Board meeting for the evening of June 19th, to be followed by a special dinner. Golf tournaments and bridge contests have been arranged by the Sports Committee. A train leaving the Pennsylvania Station, New York City, at 10:15 a. m., June 19th, and arriving at Absecon at 1:02 p. m., will carry a special car for those attending this meeting, provided 30 or more reservations are made for this train.

Fire Hazards in Cutting and Welding*

Dismantling With the Torch Without Sprinkler Protection, Ignition by Sparks Passing Through Cracks, Are Some of the Reasons for Increasing Fire Losses

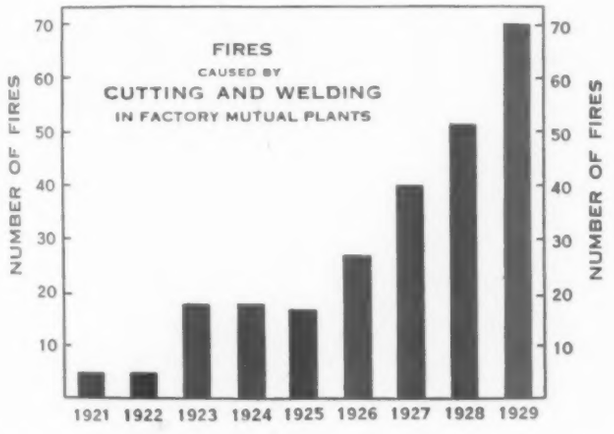
By C. W. Mowry†

THE necessary care in handling, storing, and maintaining portable cutting and welding apparatus is known by most operators; but the precautions necessary to prevent fire do not seem to have received sufficient attention. On the other hand, the accident hazards connected with such equipment are well known and are well cared for by protecting the eyes and skin of the workman by means of goggles, gauntlet gloves, and suitable clothing.

We are living in an intense industrial era. Things must be done quickly and at low cost. Therefore, portable cutting and welding outfits, which have proved to be so effective and economical, are replacing slower and more costly methods of severing and joining metals. The acetylene torch and electric-arc welder are found in factory, mill, and shop, for installation and repair work, and in the erection and demolition of buildings.

Cutting and welding outfits rarely cause fires when used properly where conditions are safe; but because these equipments are so convenient, they are used improperly at times, largely through ignorance and carelessness. Operators do not always appreciate the fire hazard connected with them, and employ the torches in locations where any open flame would be dangerous.

The hazard of matches and smoking has become the leading cause of fire, due to glowing matches and cigarette



butts thrown down carelessly here and there one at a time. It is no wonder, therefore, that fires are started by cutting and welding operations, which throw showers of sparks in all directions. Some of the sparks fly long distances and land out of sight, starting smouldering fires that break out later.

Number of Fires Rapidly Increasing

As more uses are found for these portable equipments, the more they are being employed in improper and dangerous locations. Therefore the fires due to their use are increasing.

I do not have the fire record of the entire country in this respect, but for the past eight years we have been keeping a record of the fires caused by acetylene, oxy-hydrogen, and electric-arc welding and cutting in Factory Mutual risks. As will be seen by the accompanying chart, the number of fires due to this cause is increasing with alarming rapidity. Fortunately, however, most of these fires are preventable by taking reasonable precautions.

Of the 70 fires which occurred in 1929, only eight were due to ignition of nearby material by the torch flame, and seven were due to abuses of the apparatus, such as broken hose or backfiring of a torch improperly used. The remaining 55 were all due to flying sparks which ignited paper, rags, oily waste, excelsior, and other loose combustible material, or lodged in cracks in woodwork, or fell through holes in floors to rooms below.

An important factor which has a direct bearing in the size of losses due to cutting and welding equipment is their frequent use in construction changes or for dismantling buildings in which sprinklers are out of service.

Hazards of Cutting With Sprinklers Inoperative

At one plant, the roof of one of the buildings was being replaced and the sprinklers were shut off while the change was being made. A portable cutting outfit was mounted on a platform supported on the bottom cords of the trusses. The acetylene hose became broken, and the escaping gas was ignited from the torch. The men scrambled through a hole in the roof and escaped. The heat of the fire fused the safety plugs in both the acetylene and oxygen cylinders. The resulting intense gas fire caused twelve of the steel trusses to collapse, resulting in a loss of $220,000.

At another plant, an extension was being added to a storehouse. This required cutting an opening in the building wall, which was constructed of corrugated iron on steel frame. As in the two previous cases, water was shut off in the sqrinkler system during this change. Just inside the wall of the building which was to be cut away, lay a pile of wood pulp with burlap wrapping. As a protection against the sparks from the cutting torches, the pile had been covered with an asbestos curtain and two men had been stationed on the top of the pile with carbon-tetrachloride extinguishers. In spite of these precautions, sparks rolled along the floor, passed under the curtain, and ignited the burlap covering on the bales. The fire flashed up the pile and drove the men away before they had a chance to use their extinguishers. It burrowed between the piles and caused a loss of $60,000 before it was extinguished.

Such fires illustrate the hazard that exists when cutting torches are used during construction changes, especially when water is cut off from the sprinklers. They show further that sometimes precautions are not taken at all when using these equipments, and at other times the precautions taken are not adequate.

Use of Protective Curtains

Cloth curtains and canvas tarpaulins ignite easily. Not long ago, a portable electric-arc welder was being used to enlarge the shaft on a steam generator which was being rebuilt. Two 16x20-ft. cotton tarpaulins, waterproofed with fish oil, were used to form an enclosure. Sparks from the welder suddenly ignited the tarpaulins, one of which was quickly consumed by the flash fire which occurred and which opened fifteen sprinklers.

*Paper presented at the 34th Annual Meeting of the National Fire Protection Association, held at Atlantic City, N. J., May 12-15, 1930.

†Manager, Inspection Department, Associated Factory Mutual Fire Insurance Companies, Boston, Mass.

When asbestos curtains are used, sparks may pass over, under or around them unless they are amply large and carefully placed in position. In one case, where a cutting torch was being used near terra cotta packed in straw, boards were used to cover the straw but the sparks found the cracks between the boards and ignited the straw.

What is needed most is to educate operators regarding better and more adequate precautions. Repair work should always be taken to a safe location if this is possible; but where this is not feasible, some comprehensive plan of protection should be followed. It would seem reasonable to require that before portable cutting and welding equipment is used in dangerous locations, a permit be granted by someone in authority who would see that suitable precautions and safeguards are taken. For example, the floor should be swept clean in the vicinity of the work and sprinkled with water if it is a wooden floor. All combustibles should either be moved away a safe distance or protected by adequate asbestos curtains or by canvas made flame-proof or spark-proof.

Flame-Proofing Solution for Cloth

Probably the most practicable method of flame-proofing cloth is by treating it with a solution of one part ammonium phosphate to six parts of water, both by weight. The cloth should be thoroughly wet with the solution and then allowed to dry. When so treated the cloth will char when held in a flame but will not burn or smoulder after the flame is removed. On account of the solubility of ammonium phosphate in water, cloth flame-proofed with this material cannot be used outdoors nor can it be laundered without repeating the treatment.

In addition to taking the above-described precautions, the cutting and welding operator should be provided with a liberal supply of first-aid fire equipment, and preferably should have a member of the fire brigade with him. If the building is sprinklered, the system should be in service with the valves open. Finally, the scene of the work should be watched for a while after cutting or welding has been completed, to look for evidence of smouldering fires. These are all reasonable and practicable safeguards which can be followed in most cases.

A suggested form of permit for use of portable cutting and welding equipment in factories and shops is as follows:

PERMIT FOR THE USE OF PORTABLE CUTTING AND WELDING EQUIPMENT

Date.....

Building and Room where machine is to be used.....

Description of work to be done.....

.....

Has floor been swept around work and sprinkled with water .....

Is any combustible material within 25 ft. of proposed work .....

Are sprinkler valves of room open.....

Will a member of the fire department, provided with an ample supply of fire extinguishers and buckets of water, be present while the work is being performed....

.....

.....Foreman of Room .....Fire Chief

Approved .....Plant Engr.

Time of start..... Time of finish.....

Scene of work has been inspected 30 min. after completion of work and found free of any evidence of fire.

.....Fire Chief

The City of Milwaukee has an ordinance requiring that whenever cutting torches are used for demolishing buildings, a permit shall be obtained from the fire-department authorities, who first determine that the location where the torch is to be used shall be properly protected. When specially hazardous work is to be undertaken, one of the fire-prevention inspectors is assigned to supervise the safeguards taken.

The Factory Mutual Companies recently issued a pamphlet explaining the fire hazards connected with the use of this equipment, citing some serious fires which have occurred as the result of their careless use, and outlining the desirable precautions. With each pamphlet, tags are furnished to be attached to the equipment, these outlining the most important safeguards against fire. The International Acetylene Association is also at work on the same problem, which was discussed at the annual meeting of the Association held at Chicago, in November, 1929. It is hoped that this brief discussion will bring this apparently growing hazard to the attention of those N. F. P. A. members not already familiar with it and emphasize the need of better and more adequate safeguards against fire resulting from the use of portable welding and cutting equipment.

WELDED ORDNANCE AIDS MOBILITY OF ARMY, SAYS GENERAL

A highly enthusiastic account of the development of a new process for the making of superior heavy artillery and of the use of welding in the fabrication of gun carriages and other army equipment, was given by Major-General T. C. Dickson, commander of the Watertown Arsenal, Watertown, Mass., before members and guests of the Cleveland Engineering Society in the ballroom of the Hotel Winton, in Cleveland, on May 13th.

Thanks to a light, fabricated structure built up by welding structural members to form gun carriages, the old heavy, cumbersome cast-steel carriages have been eliminated, resulting in greater mobility of artillery units.

A welded caterpillar equipment was also described which can be applied to commercial trucks used for transporting guns, enabling the truck to negotiate the most difficult terrain. The welded tread is simple in design and light in weight.

The speaker pointed out that commercial welding equipment is employed and no special process used, but emphasized that the welders must be carefully trained and the work regulated by x-ray examination. X-rays of good and bad welds were shown to illustrate the use of this process in checking the welder's work.

The new process for gun manufacture was described as a means for centrifugally casting the gun in one piece out of molybdenum steel, cold-working it to proper shape, subjecting it to a high internal hydraulic pressure, running in some cases up to 120,000 lb. per sq. in. of internal area, which increases the size of the bore, and finally subjecting it to heat treatment. This process greatly decreased the time formerly required and makes a gun of better physical properties.

TENSILE PROPERTIES OF RAIL AND OTHER STEELS AT HIGH TEMPERATURES

The results of a study made of the tensile properties at elevated temperatures of several different heats of rail steel and some other steels are included in Bureau of Standards Research Paper No. 164. Special study was made of the ductility of the steels in the temperature range of 400 to 700 deg. C., in which it was found that certain rail and other steels showed a marked decrease in elongation and reduction of area values. Data are also given on the temperature gradients existing in a rail during cooling in air and when quenched in water. A theory is presented showing that internal failures, such as "shatter cracks" and "hair cracks," may be due to thermal stresses developed in a steel structure while cooling through this temperature range.

Spot Welding in Factory Production

Maximum Production Depends on the Choice of Materials and Proper Machine Setting. Thus Reducing the Human Element as a Factor

THE use of spot welding in the production of sheet-metal equipment involves several factors that must be considered if production is to be carried on most economically. One, and perhaps the foremost, of these is the kind of steel used. The metal should be of high, uniform quality, free from scale, dirt, and grease. This is particularly true where the welders are employed on a wage-incentive plan or where they lack the necessary experience and training to detect poor-quality or dirty steel before it is spot welded. The more inconsistency there exists in the material to be welded, the more must the human element in the welder be relied upon if the welds are to stand up under conditions of service.

The maximum output of strong, uniform welds requires: (1) that the material to be welded be of uniform quality and thickness and both its surfaces be clean at the point of welding; (2) that the spot-welding machine be equipped with the proper size and shape of electrodes, and the proper adjustments be made to give the correct pressure and current density at the time of welding, with the element of time taken into consideration; and (3) that jigs or fixtures be used wherever they will help to speed up the work or will result in less spoilage.

Spot Welding in the Making of Shop and Office Equipment

The use of spot welding in the fabrication of steel factory and office equipment by the All-Steel-Equip. Co., of Aurora, Ill., is successfully meeting the requirements of economy in production. "If we could not spot weld, we should have to go out of business," is the way B. G. Wiley, advertising manager, expresses the importance of welding

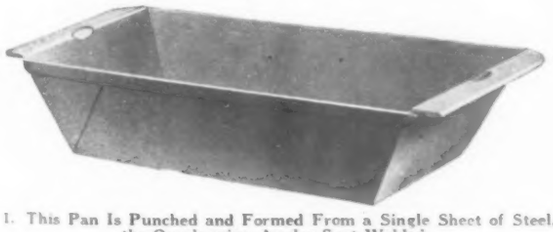


Fig. 1. This Pan Is Punched and Formed From a Single Sheet of Steel, and the Overlapping Angles Spot Welded.

in producing their line of products. The experiences of this company might be taken as typical of how a successful manufacturer would use spot welding.

The pieces entering the various products of this company are cut and formed in the plant, then delivered to the welding machines, where the welders assemble and "spot" them, the number and location of the "spots" depending on the strength and rigidity required. Whenever one of the welders changes from one kind of product to another, his machine is adjusted to meet the requirements presented by the new assembly. In the case of some of the welders who have been operating their machines for a number of years and have become very proficient in their work, they make their own adjustments to meet changes in gage, kind of steel, etc.

In some assemblies it is necessary to spot weld three pieces together in one operation, and in others to spot weld a thin-gage sheet to a thick angle iron or strap. In such cases the sizes and shapes of the electrodes are very important and the operator must exercise special precaution so he obtains a good weld without burning the metal. In one assembly a 24-gage sheet is being successfully welded to a $\frac{3}{16}$-in. steel band.

Spot Welding As a Factor in Appearance

Many of the products of this company, particularly office equipment, are given an attractive, smooth finishing coat of enamel. Such an appearance would be difficult, if not impossible, to obtain with any other means of construction than welding. The presence of rivet or bolt heads would mar the continuity of the surface unless countersinking is employed, which would not be satisfactory on small-gage

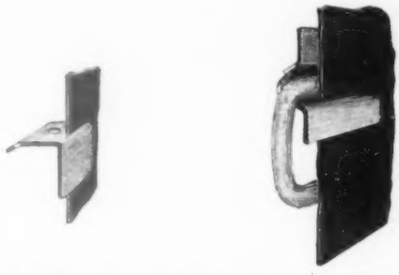


Fig. 2. By Spot Welding These Handles on the Inside of the Box or Drawer, the Stresses From Pulling or Lifting Are Taken by the Entire Flange Surface.

sheets. The welding operations are performed so as not to mar the smooth surface of the sheets, otherwise dressing would be required before applying the enamel coat.

In connection with this last point, it is important in welding the large pieces of small-gage sheet that the sheet be held in the same plane as the dressed surfaces of the electrode tips, otherwise the electrodes will deform the metal at the point of contact. In such operations, jigs are used to hold the work in the proper plane for welding.

A. F. Erickson, works manager of the All-Steel-Equip Co., is favorable toward the use of larger-capacity welders than that actually required for the work. The larger the capacity of the machine, he says, the easier it is to control the quality of the weld.

Oil-tight joints are necessary for some of the electric control equipment and shop equipment made by this company. For this purpose the Carb-O-Flux process of welding is used, employing the carbon arc.

The Use of Spot Welding in the Making of Certain Products

The taper pan shown in Fig. 1 is an excellent example of one-piece construction, with spot welding used to hold the lapped-over triangular corners in position, which gives added reinforcement to the corners of the pan. This pan is made from one piece of sheet steel, cut and formed in the company's shops. The top edges of the sides are hemmed over to strengthen the box and the ends bent to form handles, in which holes are punched to receive pull rods or for attaching stock tags.

The two types of handles shown in Fig. 2 illustrate good design for spot welding. Both handles are spot welded to the boxes from the inside, so a great deal of the strain of pulling is taken by the pressure of the flange against the front panel of the box.

One of the most interesting examples of special design to meet the requirements of economical production with spot welding is the stacking box in Fig. 3. Here the single piece

forming the bottom and the two sides has the edges flanged and lapped over the ends, where they are spot welded. The rim, which is made larger than the bottom of the box so these boxes may be stacked and remain stacked solidly, is formed from the same pieces that make up the sides and ends of the box. The stacking rim is reinforced with a steel band bent into a rectangular shape and slipped over the top edges of the sides and ends of the box, where it is spot welded. The edges of the box are then bent over the rim, the whole making a strong box with a continuous offset, self-bracing stacking rim. This type of box is adapted for many different uses besides flat stacking. For

Fig. 3. This Steel Box With Reinforced Stacking Rim Is Ingeniously Designed From Formed Pieces of Steel Sheet Welded Together.

example, they may be stacked one on another at a slant, the bottom box resting on a slant base. In this case, a spacer is laid on the stacking rim in front of each box so the boxes are held in a vertical line and several inches at the front of each box is cleared by the bottom of the next box, thus allowing the stock in each box to roll down to the front and the contents to be determined by a glance through the opening made by the spacer bar in the top.

PHYSICAL PROPERTIES OF ELECTRICALLY WELDED STEEL TUBING

A report bearing the above title has been published by the Bureau of Standards, Washington, D. C., as Research Paper No. 161. The use of tubes in many types of construction has distinct advantages over rolled structural shapes. Tubes are the conventional material in the construction of airplane fuselages; but to extend the use of tubing to other fields requires a detailed knowledge of the physical properties of the material, and much of this desirable information is not available. Hence, the Bureau of Standards, in cooperation with Steel & Tubes (Inc.), of Cleveland, Ohio, who furnished the specimens, conducted a series of tests on steel tubing having longitudinal seams welded by the electric resistance method under pressure.

The specimens selected for testing represented six different types or stages of treatment in manufacture, these being (1) as-welded, (2) cut burr, (3) swaged, (4) rolled, (5) hard rolled, and (6) annealed.

The investigation included diameters and thicknesses of the walls, tensile tests of the full sections and similar tests with the direction of stress at right angles to the weld, axial crushing tests, torsion tests, hydrostatic tests, hardness tests, flanging tests, and microscopic examinations. The specimens ranged in outside diameter from ⅝ to 3 in. and in wall thickness from 0.028 to 0.120 in.

The results indicated minimum weld strength for the swaged-annealed specimens, the figures being 51,000 lb. per sq. in. in tension and 46,000 lb. per sq. in. in compression. For the other specimens, including swaged tubes, but not annealed, the figures were higher, ranging up to a maximum of 74,000 lb. per sq. in. for hard-rolled tubes for either tension or compression. The average yield point in tension varied from 71% (minimum 67%) for swaged-annealed tubes to a high value of 95% (minimum 93%) for hard-rolled tubes.

The average elongation varied from 48% in 2 in. (31% in 8 in.) for swaged-annealed tubes to 8% in 2 in. (3% in 8 in.) for hard-rolled tubes.

In the torsion test the average shearing stress in the extreme fibers at the proportional limit for the swaged tubes was 22,610 lb. per sq. in., for the rolled tubes 22,190 lb. per sq. in., and for the hard-rolled tubes 30,310 lb. per sq. in. No fracture occurred in the weld or in the base metal of any of the specimens even when twisting was continued after the ultimate torque was reached.

In the hydrostatic test the average bursting strength ranged from a maximum of 79,950 lb. per sq. in. for the hard-rolled tubes to a minimum of 47,840 lb. per sq. in. for the swaged-annealed tubes. Of the 30 specimens other than the annealed tubes, only one failed in the weld, and this at a high bursting strength. On the other hand, only one out of the six annealed specimens fractured outside the weld. This indicated that the annealing process reduced the strength of the weld about 10% below that of the base metal. The bursting strengths of the tubes that failed near the weld were practically the same as those of the tubes that failed at a distance from the weld. The average bursting strength of the five swaged-annealed tubes that fractured in the weld was about 90% of the bursting strength of the tube that fractured outside the weld.

The average tensile strength obtained by testing circumferential strips cut from the tube was practically the same as the longitudinal tensile strength of the same tube. An exception to this was the tensile strength of the strips from the two swaged-annealed tubes that fractured in the weld, and the average tensile strength of these was about 93% of the strength of the base metal.

The microscopic examination indicated no overheating or burning of the metal at the weld. The edges at the seam were heated to the welding temperature and immediately forced together in the process of manufacture. Apparently there were no more inclusions at the weld than in the base metal.

The conclusion is reached that, except in the case of swaged-annealed tubing, the properties of the base metal (the metal not affected by the welding operation) can be used in determining the working stresses for different structural uses of tubing made by the process used in the manufacture of this electrically welded tubing, no allowance being necessary for the altered structure in and adjacent to the weld. The properties at and near the weld for annealed tubing are sometimes slightly lower than the properties for the base metal.

URGE USE OF ROLLED STEEL SHEETS

An advertising and sales campaign built around the slogan "Save with Steel" has been launched by the Trade Research Division of the National Association of Flat Rolled Steel Manufacturers, representing more than 90 per cent of the hot- and cold-rolled sheet and strip production of the country and embracing 32 individual contributors. More than 5,000 different products, ranging in size from carpet tacks to Pullman cars and standardized buildings, are made of rolled steel sheets and strips, and this campaign aims to acquaint the public with the important part that steel plays in their comfort and well-being, and to suggest to the manufacturer ways in which the further use of rolled sheets and strips will better his product and increase his profits. The welding industry will follow this campaign with interest, as a considerable part of sheets and strips being used to-day is being welded, and an increase in the use of products from these mills is expected to result in at least a proportionate increase in the application of welding.

Standard Practice Rules for Welding

Welding Specifications for the Railroad Shop Should Include Data on the Electric, Gas and Thermit Processes and Rules of Procedure and Application

By Robert Moran

A STANDARD Practice can be defined as a practice that has been approved and adopted after repeated methods and tests have been conducted to determine what is the most practicable and economical method.

What is to be gained by the adoption of Standard Practice Rules for welding? There are many reasons favorable to the adoption of Standard Practice Rules or Welding Specifications, the chief ones being:

(1) It systemizes work.

(2) There is a sense of security in knowing the work has been done as safe and practicable as possible.

(3) It takes the guess work out of the work.

(4) It makes the welding operator a better mechanic, not only in his own profession but in other lines of work he may be called upon to perform.

(5) It is not only a saving in dollars and cents, but questionable hazards are eliminated.

(6) It does not require additional supervision.

When a welding operator is assigned to a welding job, whether it be a broken locomotive cylinder, broken frame, or the welding of a patch in the side sheet of a fire box, he naturally makes plans and decides before the commencement of the job just how it must be done to make the job a success. In other words, he makes a picture in his mind of what the job must look like when completed. He then proceeds with his work until this has been attained.

Completed Work Must Meet Federal Inspection

What would be the results if the mechanical department of a railroad permitted their welding operators to perform the various welding jobs as they saw fit? The results would be that federal inspectors would camp right on the railroad who permitted such a condition to exist, and the inspectors would probably run out of Form 5's. This means engines cannot operate until defects have been remedied to the satisfaction of the federal inspectors. Of course we all know that these conditions do not exist today, but conditions like this could happen if the railroads did not have set rules for welding or welding specifications for the guidance of supervisory officers and welding operators.

It requires a great deal of time and expense on the part of a railroad to create their welding specification folio; such a venture takes possibly a year; and each year it should be revised to keep it up to date as the railroads purchase more modern equipment fitted with better appliances; for example, cast-iron castings are replaced with cast steel, alloy steel is used in the place of common forgings and castings, endeavoring to get better wearing quality and strength in motion parts and parts in tension. With these changes it behooves the mechanical department of the railroad to revise their welding folio to meet with these changes.

Procedure Should Be Rigidly Defined

A Standard Practice Specification, or a welding folio, should be positive in its instructions, illustrations, and rules. There should be no leeway as to the next best procedure. If the welding operation cannot be performed as stated and illustrated by blue prints or drawings in the welding folio, it should not be done; the results might be hazardous, as already mentioned. In other words, the parts or jobs that the mechanical department do not approve of welding, should be illustrated or mentioned in a list of "dont's" in the preface of the welding folio, "This not to be welded." Here we have a positive order, and all concerned know what to do if that particular part which is listed under the "don't" column has become worn or broken.

Other welding operations that have been approved by the mechanical department should be listed in the folio according to their relation to the various departments who do welding. For instance, all welding pertaining to the boiler shop should be listed and described in the boiler-welding section. The same should be done for welding operations which come under the classification of machine-shop welding, or coach shop, wheel shop, etc. It is very important that welding specifications state clearly which jobs shall be done by the oxy-acetylene process and electric-arc process, together with the kind and size of filler rod or electrode. In the case of electric-arc welding, if the welding operation is to be performed with the electrode positive, it should be so stated.

Success Requires Proper Preparation of Work

The method of preparing work for welding should be given great thought in the making of welding specifications, as good preparation for welding is half the job done, and careless preparation generally results in failure.

Since electric-arc, oxy-acetylene, and thermit welding play an important part in the maintenance of railroad equipment, a welding folio should contain data pertaining to the three processes, each to be complete in itself.

Greater efficiency can be obtained if the mechanical departments of railroads insisted that supervisory officers, as well as welding operators, familiarize themselves with the contents of the standard welding specifications. They should get acquainted with them and be as proficient in the knowledge of welding and its applications as they are in reciting ARA rulings and government defects on locomotives and tenders. It has been my privilege to observe these conditions. That it is a bad state of affairs is evident when one considers how important an asset welding is to the railroads.

WHERE ARE YOU VACATIONING?

This is also vacation time in the post office. Under the law, letter carriers must be given 15 days' vacation, exclusive of Sundays and holidays. But vacation or no vacation, the mail must move and deliveries must be made. During the absence of the carrier, delivery is made by a substitute who is often limited in experience and may be wholly unfamiliar with the district and those who live in it. Under the best circumstances delivery is not an easy task for the experienced carrier, and when a substitute is sent out on the district delivery is often impossible because of the failure of patrons to cooperate with the post office by providing a proper receptacle for their mail, with the name of the resident plainly shown above the box. It is particularly desirable that the names of visitors who expect mail shall be placed over the box during the period of their stay, or that their mail be addressed in care of the person whose name does appear on the box. Arthur Lueder, the Chicago postmaster, says patrons can do a great deal to expedite delivery and make a hard, grinding task easier for the substitute by following this plan.

DALLAS TO HAVE TALLEST WELDED BUILDING

An all-electrically-welded building 19 stories high, the tallest yet to be undertaken, is now being constructed for the Dallas Power & Light Co., in Dallas, Texas. The new structure will be used as an office building.

Construction began March 15th. Excavation has been completed and footings have been set. The first steel was expected on the job by July 1st. Steel fabrication and erection will be done by the Mosher Steel & Machinery Co., using General Electric welding equipment. Lang and Witchell are the architects, and R. L. Rolfe is structural engineer for the building. Frank P. McKibben has been retained as consulting engineer in connection with the welding.

Dallas is the largest city in the United States to sanction, in its building code, the use of welding in the construction of buildings. So far, 79 cities are known to have adopted codes which allow welding, almost all of which are in the South and West. Pittsfield, Mass., Wilmington, Del., Lynn, Mass., and Syracuse, N. Y., are the only eastern cities which have taken this step.

It is interesting to note, however, that the greater number of welded buildings are in the eastern part of the country, although the building codes do not nominally allow welding. A recent compilation shows over 50 buildings already welded or in process, about 80% of which are situated in the eastern part of the country.

EVERYBODY'S BUSINESS

(*Concluded from page 31*)

weather. Windowless buildings are already being constructed in half a dozen American cities.

We do not have to project present-day tendencies very far to visualize multi-deck cities with traffic running 10 or 15 stories above the main streets. This will mean churches in high towers and huge bridges connecting towering skyscrapers. Aggregations of massive steel structures will tower above deep abysses and will become centers of art, engineering, business, chemistry, manufacturing, publishing and other special lines of enterprise.

Taking just one newly developed section of New York City covering 12 blocks, we here find buildings under way that will house more people than the combined populations of Cheyenne, Brownsville, Reno, Asbury Park and Boise. The new Lincoln and Chrysler buildings in our chief metropolis, if rented to capacity, will bring almost 25,000 people into one spot. The Empire State building, which will be the largest office and business structure in the world, will come close to housing the total populations of Sioux Falls, Bismarck and Albuquerque.

Traditional Methods No Longer Meet the Test

It is now necessary to discard traditional ideas of how things must be done. Present plans for one of the newest and tallest of American buildings call for the use of glass brick for the top seven floors of this imposing edifice. This offers a new opportunity for the sale of more glass.

The use of steel construction for small homes promises to gain popularity, and such a vogue coupled with that of steel furniture and hundreds of other products made of iron will rapidly expand the markets of the metal industries. Steel floors are fireproof, they can be given frequent new surfaces of tile, their weight is less than that of floors now in use and they will reduce ceiling-floor thickness several inches.

The greatest defect today is that our responsible groups of social and business leaders are trying to control and direct a 20th century material civilization while possessed of a mental life and outlook of the 17th century. Reaching for success at present without carefully studying the likely courses of current development is like looking in a dark alley for a black cat that isn't there.

It is not easy for the average person to exercise sufficient imagination to grasp the full significance of most new inventions. It has always been that way. Watt saw in his engine only a new way of draining English mines, and never dreamed of mass production in factories. Bell thought only of the deaf mutes for whom his experiments were undertaken, and did not look ahead to a world enmeshed in telephone wires. Edison did not foresee that his electric lamp would make the electrician at a theater switchboard almost as important a factor in many a play as the actors on the stage.

The same shortsightedness prevails today and that is why changes now break upon us with such unexpected force and such costly results. This very moment is none too soon to commence to prepare for a multitude of new developments. Our big cities are taking steps to build up a radio crime service that will instantly send the nearest police car speeding to a scene of disorder. Voice communication by members of the police forces will be on a frequency above the broadcast band so it cannot be received by the ordinary set.

New Forces Are Abroad in Aviation

New airports will soon be bringing communities in their wake. Homes, stores, schools and churches will spring up around the factories that will produce the ships of the air. Almost without knowing it, we have made aviation in America a billion-dollar industry. Airplane exports have quickly tripled. We have 600 aviation schools and 2,000 factories engaged in manufacturing one thing or another for aeronautics. It is just a step to planes as foolproof as automobiles, and types of machines that will make perpendicular ascents and landings. Then it is only a single further step to the transformation of the entire world into one great airport, with every roof a possible landing field.

I might continue and tell of wonderful advances in dozens of lines even in ice engineering. Although we cannot control climate, it appears that we may control the evils that climate brings. Means are at hand to overcome the difficulties that result from frozen rivers. There is even the probability of our being able to reduce, if not destroy, the ice-forming quality of water, thereby hastening the spring break-up by two or three weeks. Fewer floods from ice jams means greater safety for life and less loss of property.

Although the story of tomorrow is practically endless, it is one that each of us should study with infinite care. Never before was it so necessary to get away from the idea that the practice or product of today must resemble that of yesterday. We laugh at the idea of the first automobile being built entirely along the lines of an old-fashioned buggy with a dashboard and whip socket. But let us not forget that our children will grow up and look back with no less amusement at the absurdity of many of our present modes.

We must think of the future in terms of television, of travel by air, of a thousand practical uses for the photo-electric cell, of light diffused from sources different from lamps and without wire connections, of highways with speed limits of 100 miles an hour, of vast networks of pipe lines carrying fuel, and of dozens of other equally startling developments that will totally change human habits.

Only a few years ago it required considerable imagination to picture a time when the business man in America could sit at his desk and talk with a friend in Europe. Now such conversations take place every hour of the day. So will tomorrow bring revolutions. Marvels now comprehended with difficulty will be everyday actualities.

Your business and mine may this minute be at the beginning of a transformation due to something just emerging from the laboratory stage.

Scientific Prediction of Weld Behavior*

To Determine Accurately the Cost and Other Properties of a Welded Product Requires Consideration of All Factors Affecting Weld Behavior

By R. E. Kinkead

A CLEAR statement of the service required of a weld is necessary if predictable results are to be obtained from a welded structure. To be economically practicable, welds must be made to meet service requirements. It is not sufficient to state that the weld should be as good as possible and as cheap as possible. A weld which would be good under one set of service conditions might be entirely unsatisfactory under another set of service conditions. Unless the service requirements are known and can be accurately stated, there is no way by which a conclusion can be drawn as to whether or not a particular weld will meet the requirements.

A weld which is merely stronger than the pieces joined is not necessarily a weld which is most desirable from a service point of view. For instance, where corrosion resistance or resistance to fatigue is required, the mere fact that the weld is stronger in tension than the pieces joined has no relation whatever to its behavior under service conditions. It is quite possible, and unfortunately common practice, to make welds which are stronger than the pieces joined, but which have absurdly low resistance to both fatigue and corrosion.

Making a weld to meet conditions which are unknown is as futile as to buy a drill before knowing what size hole is to be made.

Behavior of Welds Predictable

The behavior of welds under service conditions must be predictable to a high degree of certainty. Unless weld behavior can be so predicted, there is no way of estimating either cost or value of the welded product. If nine welded products in a group meet service requirements, but the tenth unit fails, there is no way of estimating the average cost of the product unless the exact cost of failure is known. A welded product having a service life of ten years may have twice as much value as a similar product having a life of only five years. The cost of a product delivered to the point at which it is to be used is only one element in the eventual cost of using the product. Since neither the cost nor the value of the product can be known unless its behavior under service conditions can be predicted, accurate knowledge of weld behavior is essential.

Control of the Variables Is Possible

The methods by which weld behavior is predicted to a satisfying degree of accuracy are identical in every respect to methods by which the result of any other mechanical operation is predicted. Automobile production is carried out with such precision that the car may be delivered to the user without any test whatever of its ability to meet service requirements. The man who bored the cylinders may or may not have a high degree of skill or may not have good intent toward the management of the automobile plant, yet the product has a constant quality which is known to a high degree of certainty before production is ever started. Such manufacturing methods involve control of the variables to such an extent as to produce constant results.

Any welding operation is composed of a group of moving events which may be called variables. Within certain limits of variation in each case, the combination of these moving events which comprise the welding operation will produce a predictable result—namely, a weld, the properties of which will fall within certain limits. When the manner in which each moving event varies is known, the probability that any particular result will be obtained may be stated. Under these conditions, it may also be stated what the probability is that a certain minimum requirement will not be met.

Procedure Control Necessary

Procedure control is necessary in the case of welding operations as in any other mechanical operation if predictable results are to be obtained. Eight to twenty moving events cannot be allowed to vary in an uncontrolled way if the same result is expected each time the operation is repeated. The object of procedure control is to hold each moving event to limits of variation sufficiently close that, when combined with other similarly controlled moving events of the group comprising the welding operation, the result will fall within specified limits.

The properties of a welded structure which should be predicted with accuracy are: cost, continuity of service, maintenance, and life in service.

The term "cost" in this case includes the item of rejected units at the point of manufacture if there is a probability that all units manufactured will not meet the specified requirements. Also costs arising from expenditures on "good will" take account of probable failures of the product in service. The requirement in this case is a statement of the probability that the product will not fail in service. The cost might be insignificant if there were only one chance in ten thousand of failure with a possible expenditure of $100; but if the possible expenditure were of the order of $500,000, this item would become important. Without such a prediction, a business institution would have to have a strong belief in the efficacy of prayer to go into production.

Inspection Also Necessary

Inspection is a necessary part of any procedure control designed to produce predictable results from welding. The function of inspection is actually to maintain the necessary control over the limits of variation of each moving event which is involved in the group comprising the welding operation. These limits must be effectively maintained without regard to the skill or good intent of the individuals whose combined efforts produce the finished product.

Qualities of Metal Important

Welding qualities of metals to be welded together must be taken into account in order to produce a predictable result from welding operations. Application of welding heat to any material has some effect on the physical properties of the metal adjacent to the weld. Except in what is known as "welding quality" steel, the usual effect is to depreciate one or more of the original physical properties of the metal adjacent to the weld. Unless the precise amount of such effect is known and its relation to service requirements explored, the results of the welding operation will be uncertain.

The weld metal itself is subjected to the effect of the

*Summary of a paper delivered April 4, 1930, before the Cleveland Section, American Welding Society, and describing material in forthcoming book.

welding heat, with subsequent rapid cooling, and to residual strain set up by this heat cycle. To produce predictable results from welding, the precise amount of these effects must be known, under the conditions present at the time the weld was made.

Contour of the weld section has an important effect upon concentration of stress in the locality of the weld. Such stress concentration due to a particular contour may result in loads amounting to four or five times the average loading in the material which was welded together. Unless the amount of such stress localization is known, the behavior of the weld is uncertain.

Resistance of the weld metal and of the material adjacent thereto to corrosion and other service requirements must be known if the behavior of the welded joint is to be predictable.

All the properties and characteristics of the metal in the weld and of the metal adjacent to the weld are either known or ascertainable. If there is any uncertainty about the behavior of a weld under service conditions, this uncertainty arises from one of two reasons: either the true service requirements were not known, or ascertainable facts in connection with the weld were not taken into account in the design of the welded structure.

ADVOCATES STEEL HOUSE CONSTRUCTION

The general adoption of steel construction for the 800,000 residences that are built each year in the United States would result in more than doubling the present consumption of structural steel, and would make a permanent fireproof structure whose construction could not be cheapened at the homeowner's expense and hence would offer a more attractive field to the money lender, according to Lee H. Miller, chief engineer, American Institute of Steel Construction, who advanced these arguments in a paper he read before the Institute at New York City, on May 9th.

Mr. Miller attempts to arouse the steel industry to a concerted attack on this problem, aiming their onslaught at what he considers to be the most vulnerable point—namely, the residence floor. "The floor," he says, "has been the unsatisfactory, empirical and indeterminate part of buildings," and he proposes the adoption of the battledeck floor of welded steel-plate construction, which was described in the January issue of *The Welding Engineer*. After steel is being used for floors, it will be comparatively easy to promote its use for such other features as interior framing, partitions and roofs. Enlarging on this type of steel floor construcion, Mr. Miller says:

"For many centuries the world has looked for a satisfactory floor, and developments of the steel age, which started about 1880, should enable the steel industry to provide such a floor. The most severe service any floor receives is the ore-carrying ships or the charging floors of open-hearth furnaces, and the most palatial environment a floor has is no doubt found on the fine ocean liners. In such cases only steel can meet the requirements.

"Steel plates 5/8 in. thick are used without stiffeners for the horizontal bottom plates of bins up to 18 ft. square in connection with steel-mill construction, and such floors carry live loads as great as 3,000 lb. per sq. ft. This type of floor is, however, too flexible for ordinary occupancy and would require stiffeners to eliminate flexibility. Steel plates 24 in. wide and 3/16 or 1/4 in. thick can be supported at their edges on parallel beams 3, 4 or more inches in depth, and by automatic welders the plates and beams can be united to give a floor of great strength, free from flexibility.

"This floor can be fireproofed on the ceiling side to resist the complete destruction of the contents by fire without losing its strength. It can be given top surface treatment to meet any occupancy requirement, and all for a first cost that justifies its universal use. It will be free from shrinkage, warping, and other annoying features. Covered with cork tile laid in a mosaic pattern, it eliminates the necessity of carpets except as ornaments, and the cost complete is less than that of a good domestic carpet required to cover other types of floors."

For light loads and relatively short spans, which are the conditions met with in residence construction, the weight of the steel in the floor would be approximately 10 lb. per sq. ft. Assuming an average figure of 1,500 sq. ft. of floor area for each of the 800,000 homes built in a year, Mr. Miller points out that this opens up a field for the consumption of 6,000,000 tons of steel, which figure is made all the more interesting by comparison with the structural-steel consumption in the United States in 1929, which was 3,850,000 tons.

T. J. Foster is quoted to the effect that the research of the Department of Commerce indicates that a waste of two billion dollars a year, or 53 per cent, exists in the building industry; in other words, the public gets only 47 per cent of what they pay for. This supports the claim made that the house-construction industry permits of almost unlimited scope in debasing standards and values to a point where first cost makes honest construction very difficult to market.

"With the most perfect construction material that man has ever known," says Mr. Miller, "the steel industry holds the solution to a condition that may be properly described as a national calamity. One hundred per cent honest construction could have a first cost double the first cost of average current practice, and still be 6 per cent cheaper than current first costs. This may indicate why it is easier to finance the purchase of an automobile than it is a supposedly permanent home investment.

"If the Department of Commerce figures on waste are correct, the loan companies which allow 50 per cent of the cost are actually lending about 100 per cent of the actual value. It should be possible to educate the financiers on the question of the relation of values and cost and bring about an attitude of self-preservation that would result in a distinction between honest and dishonest construction."

The salvation of the home buyer who wants to get a dollar's value for every dollar he pays out and of the financier who wants his loans to be protected by value that really exists and is not camouflage, lies in the use of steel construction, Mr. Miller believes.

"If the house construction is ever to experience a high standard that will justfy a more liberal consideration from financiers, it must come through the introduction of new materials properly designed and installed," he says. "Steel construction details can be standardized on a universal basis sufficiently comprehensive to enable the financier to know that it is largely free from the debased existing methods which show 53 per cent waste. He will be more willing to lend 80 per cent on a house whose value is 100 per cent of its cost than he will to lend 50 per cent on one whose value is only 47 per cent of its cost. Once a distinction is made in financing, the ultimate cost to the owner is less and the greater ease of financing makes a small increase in the initial cost less burdensome than the existing methods."

The steel floor ultimately will be adopted, said Mr. Miller, but all the interested parts of the steel industry acting in cooperation are essential to effect this program; and once the financial interests realize the increased security of 90 to 100 per cent perfect construction, it will become easier to finance a home than an automobile. The cooperation of different national associations promoting products for fire safe construction has already been assured in the carrying out of this program.

Safe Operation of Acetylene Generators*

Correct Installation, Experienced Operator, Periodic Inspection and Keeping of Operating Records Make for Safety and Economy

PRESENT-DAY plant managament is vitally concerned with maintaining equipment so that it operates with the greatest possible safety and economy. The condition of the acetylene-generating equipment is of special concern, first, because production depends on its continuous operation, and second, because it is usually built to comply with certain regulations, and it should be maintained in this condition in the interests of safety. Shut-downs are expensive, as they upset production schedules and cause costly delays. In many present-day plants where acetylene is piped throughout several important departments, it is so closely tied up with production operations that failure of the acetylene supply is equivalent to a power shut down and affects the shop just as seriously. Well-kept generating equipment always indicates economical generation of gas, because leaks are stopped, correct pressures are maintained, and general efficiency is achieved thereby.

It is quite in order, therefore, that acetylene generators be thoroughly inspected at regular intervals to check up on their condition and to make any necessary repairs. The frequency of this inspection will depend upon plant and operating conditions. An annual inspection will suffice for the majority of the smaller installations, but for the larger installations where operating demands are heavier a semi-annual or quarterly inspection is preferable.

The Generator Foundation

The first important item to note is the position of the generator on its foundation. Properly installed on a solid foundation such as a heavy concrete slab, the generator will remain in the position in which it was originally set. If, however, the supporting structure is of wood or other insubstantial material, or if the generator house is located on filled or swampy ground, the settling of the building may allow the generator to get out of line and hence throw strains on the connections to the piping, causing them to develop leaks. Moreover, a generator which is not in a level position cannot operate in a satisfactory and efficient manner. In such a case, steps should be taken to overcome these faults in the generator house construction, and then the generator can be leveled and re-aligned in the correct operating position.

That part of the floor directly beneath the generator should be as dry and well ventilated as possible, as this will tend to keep the generator bottom free from rust. Grooves in the concrete which drain into the sludge trough will prevent water from accumulating in this area. Most generators are built so as to permit the free circulation of air in this space. An excess of water beneath the generator, not otherwise accounted for, would, of course, be evidence of a leaky bottom and this should be investigated and repaired.

The generator shell and all other sheet-metal parts of the generator installation should be carefully examined for leaks. Leaks below the water line will, of course, be quite apparent due to the presence of moisture, rust, or corrosion. Above the water line it will usually be necessary to test joints and suspected areas in the sheet metal with soap suds. It will pay to analyze a leaky condition and try to determine the cause. Frequently faulty operating practice, such as straining at a corroded plug-cock with a large wrench, will develop leaks which could have been prevented and which cannot be justly attributed to faulty generator construction.

If leaks are found which require heat for making the repair, even though it be only the heat of a soldering iron, the only safe procedure is to remove the generator from the generator house to the open air; fill the main chamber and all minor compartments with water to exclude the last trace of acetylene; and then after draining sufficient water to get at the leak apply welding or soldering heat.

Examining the Working Parts

The carbide feeding mechanism should be carefully examined in all its details. The importance of this part of the inspection cannot be emphasized too strongly, because failure of any part of the carbide-feeding device means that the unit so affected ceases to generate gas. This may cause the entire acetylene system to be without gas, resulting in the shut-down of important production departments. The loss of time and money involved makes such an occurrence very costly. Even if complete failure of the carbide-feeding mechanism does not occur, a feeding mechanism that is badly out of adjustment will frequently permit the line pressure to drop to a point where the torches will not operate. If a clock-work motor is used for the drive, the wear of the gearing and all moving parts should be checked, and badly worn parts replaced. All parts should be thoroughly cleaned and the bearings lubricated sparingly with light machine oil, and excess oil wiped off. If the motor is actuated by a weight, the suspending cable should be examined for broken strands and replaced if apparent wear indicates that this is necessary.

If installation conditions permit, the carbide hopper and that part of the feeding mechanism which is attached to it should be removed from the shell for thorough cleaning inside and out, scraping off of caked lime, and for general overhauling and repairing of such parts as plows, sweep-rings, feed valves, etc. The inside of the generator shell should also be thoroughly cleaned of all caked lime and sludge. In case the generator is located in a space where there is not sufficient head room to permit the hopper to be lifted from the generator body, it will be necessary to remove the generator from the generator room to a location where there is enough clearance to properly accomplish this part of the overhaul. When removing the hopper or doing any work whatever on it when it is in place on the generator, it is a safe rule to have the generator filled with water to the operating level.

The condition of all the rubber parts of the generator such as diaphragms and gaskets should be ascertained. Old rubber becomes dry and loses its resilience and hence is not effective for its intended purpose. Rubber parts are inexpensive and it will pay to renew them at least once a year.

Testing for Leaks with Soap Suds

After pressure is again on the reassembled generator, test all joints and stuffing boxes for leaks with soap suds. Note whether the agitator shaft stuffingbox leaks water, and either tighten or renew packing in all leaking stuffingboxes. One-eighth-inch round graphite-treated asbestos packing is

*From International Acetylene Association Forum.

quite generally employed for this purpose. Gas cocks should be kept free from leaks, and as a means to this end the plugs should be removed from the cocks at the time of periodical inspection or more often if required, and should be carefully wiped and lubricated with a small amount of high-quality cock grease. The grease should be used sparingly, just enough being applied to form a thin film over the entire working surface of the plug.

The blow-off valves should be carefully examined for leakage. A considerable leakage past a blow-off valve can be detected by listening to the escape of gas past the seat. For detecting a slight leakage it will be necessary to form a soap bubble over the vent pipe outlet.

The importance, from an economic standpoint, of eliminating leaks is quite obvious. Nevertheless, their presence is often overlooked; and when gas costs go up, the gas yield of the carbide is sometimes questioned or some other erroneous explanation given. It does not take a very large leak to pass as much gas as a medium-size torch, and the leak is never turned off but continues day and night as long as there is pressure behind it. It is for this reason that an inspection, which checks such leaks and preserves this valuable gas for useful purposes instead of allowing it to become a hazard, cannot be neglected in any well-managed plant.

Select Generator Operator with Care

Intelligence is required for the proper operation and care of an acetylene-generator installation. It is a task that should not be assigned to the ordinary man-of-all-jobs. The generator operator ought to be selected with care and placed in charge only after being deemed competent by the plant management. This does not mean that the operation of a generator requires a highly trained man, but it does mean that the one in charge should be a conscientious mechanic who recognizes the responsibility of his work and who is thoroughly reliable and of a disposition to follow written instructions closely. The employment of a man of this type will show a profit in the long run because he is the most important factor in the prevention of shutdowns with the costly loss of production which they entail. By his alertness he will see to it that the gas pressure is always such as to insure efficient torch operation. He will be on hand early enough in the morning to have pressure on the lines ready for starting when the whistle blows. He will not leave at night until everything about the generators and generator house is in order and ready for the next day's operation.

Except in the case of the larger installations, generator operation will require only a small part of a man's time. It is advisable in such a case to assign the job to some one man, it may be one of the torch operators, and to hold him solely responsible. A telltale gauge installed near where he is working will keep him informed of conditions in the generator room. He may require a helper or an under-study. In fact, it is very desirable to have a second man familiar with the equipment in case of the first man's absence. But the important thing is that there shall be no evasion of duties or shifting of responsibility.

In the case of a plant working day and night with more than one shift, it will probably be necessary to have an operator for each shift, but even in such a case there should be one chief operator, or supervision by some competent authority. An extra hazard is always introduced when a generator installation is operated by any one who happens to be free at the moment or by more than one man without proper control or direction. Therefore, special care must be taken to see that each operator is instructed in all the details of operation and that he carries out these instructions.

Furthermore, it is important that the handling of the generators by the operators on the various shifts coordinate so that safe operation will be continuous. As an aid towards this coordination a log sheet similar to the one outlined is suggested so that a continuous history of operating conditions is readily available.

Example of a Log Sheet

The use of a log sheet requires each generator to be marked by a number to identify it. The figures 1, 2 and 3 which have been inserted on the typical log sheet refer to generators bearing these numbers. For example, in this record, it is assumed that generators Nos. 1 and 2 were carrying the load previous to 7 a. m. when this record starts. They continued to carry the load until 10 a. m. when generator No. 3, which was filled with water at 7 a. m. and charged with carbide at 8 a. m., was turned on the line and generator No. 1 was shut down at the same time. After being recharged, generator No. 1 was put back on the line at noon, and from this time until 7 p. m. all three generators were on the line, except from 3 p. m. to 5 p. m. when generator No. 2 was being recharged. From 7 p. m. to 7 a. m. only two generators were on the line at the same time, generator No. 1 having been replaced by generator No. 3 at 9 p. m. and generator No. 2 having been replaced by generator No. 1 at 3 a. m.

The carbide inventory will prove useful in that it indicates when carbide must be ordered. The carbide consumption figures may be kept on a monthly basis or such other period as will be convenient to the cost accounting department.

As a further safeguard against operating mistakes incident to the change of personnel on a new shift, it is the practice in well-managed plants to have a set of signs printed and hung on the generators to indicate conditions

BLANK COMPANY

ACETYLENE GENERATOR LOG SHEET

Main Street Plant Operation From 7 A.M. 3 (Month) 24 (Day) 1930 (Year)

To 7 A.M. 3 (Month) 25 (Day) 1930 (Year)

Time	Generator Nos. 1 - 2 - 3 Water Filled	Carbide Charged	Pounds	Time Started	Time Stopped	Operator	Remarks
7	3					J.L.Smith	
8		3	300				
9							
10	1			3	1		
11		1	300				
Noon				1			
1							
2							
3	2				2	D.M.Black	
4		2	300				
5				2			
6							
7	3				3		
8		3	300				
9	1			3	1		
10		1	300				
11						H.A.Jones	
Midnite							
1							
2							
3	2			1	2		
4		2	300				
5							
6							
7							

Pounds Carbide Used		1800
Hours Generator Operated	1.... 16 2.... 18 3.... 19	

Carbide Used	March
Brought Forward	27000
Used Today	1800
Total Used to Date	28800

Carbide Inventory

Brought Forward	5000
Received	10000
Total	15000
Used Today	1800
On Hand	13200

at any particular time. These signs are used constantly during the working period and enable the succeeding shift to know in exactly what condition the generators have been left by the retiring shift.

These cards would read, "Discharged—Not Emptied," "Water Filled, Carbide Charged and Purged," and "On Line." Cases have occurred where lack of this knowledge has led to accidents when the generators were taken over by a succeeding operator.

The operation of the larger multiple generator installations will be along these same lines, the only difference being that the entire time of an operator and possibly a helper will usually be required for each shift.

MANUFACTURES CARBIDE DRUMS FOR FIVE YEARS WITHOUT AN ACCIDENT

Employment representing 116,800 man-hours of work without a single lost-time accident is a record that the Midwest Carbide Corp., Keokuk, Iowa, can justly feel proud of. The work included the fabrication and welding of carbide drums. T. F. Wettstein, vice-president and manager of the company, is quoted as follows in a recent bulletin of the National Safety Council:

"Five years ago, we started to manufacture our own carbide drums here at our plant. These drums are about 12½ in. in diameter by about 22 in. high, and made of 26-gage corrugated steel. We purchase the sheets cut, except for trimming, and work them through to a finished and painted product. On April 23rd this can shop had completed five continuous years of manufacture, and in that period of time had never had a single lost-time accident. There were an average of ten men employed; their employment represents 116,800 man-hours of work.

"The operations include trimming shears, forming rolls, side seamers, corrugators and flangers, top and bottom seamers, punch presses and drawing presses, threading machine, and electric welder."

NEW BATTLEDECK FLOOR CONSTRUCTION

New structures incorporating the battledeck type of flooring, consisting of steel plates welded to I-beam stringers, are announced in the June, 1930, issue of *Aminsteel*, published by the American Institute of Steel Construction.

The Erie Railroad has invited bids for Pier No. 6, Hudson River, on which is involved approximately 210,000 sq. ft. of battledeck flooring in two floors and the roof of the pier shed. About 1,200 tons of plates will be required.

The A. O. Smith Corp., of Milwaukee, has incorporated approximately 150,000 sq. ft. of battledeck flooring in the new engineering laboratory building now under construction. This will be eight stories in height, the other dimensions being 170x185 ft., and all floors will be of the battledeck type.

The *San Francisco Chronicle* is quoted to the effect that a contract for a ship-loading platform for the Harbor Commission, San Francisco, calling for 300 tons of plates, has been awarded to the Herrick Iron Works. This is said to mark the first installation of battledeck flooring on the Pacific Coast. More than 2,000 sq. ft. of ⅞-in. plate will be required.

Battledeck flooring was the subject of a general discussion entered into at a dinner meeting of the Structural Engineers Society of New York, held at the Old Westbury Golf Club on Long Island on May 14th.

Such importance is attached to this type of flooring that the Civil Engineering Department at the Georgia Institute of Technology, at Atlanta, which is under the general supervision of Professor F. C. Snow, and directly under Professor Smith with regard to structural design, is giving a course in battledeck-floor design. One of the problems, the solution of which is a requisite for graduation, is a building designed with battledeck floors in comparison with a steel-frame building with concrete floors. Professor Smith is given as the authority for the statement that the individual solutions all indicate a decided economy in the new type of construction.

ISSUES BOOK ON STADIA

When General Pershing gave encouragement to the manly art of boxing he restored prize-fighting to a position of honor among sports. That was, however, but one incident in the tremendous growth in athletic contests in the United States since 1920. As a result of this renewed interest in sports, stadia and arenas are today being constructed in every city and town of importance.

Recognizing the need for an instructive treatise on the design and construction of such buildings, the American Institute of Steel Construction has just published a book by Myron W. Serby, entitled "The Stadium." Mr. Serby is a structural engineer who has had many years' experience in the design and construction of this particular type of building, and he has amassed many facts which have never before appeared in print.

It is a volume which should prove of inestimable value to the structural engineer or architect commissioned to design a stadium, and of like worth to the college or other management planning such a structure. In text, illustration, design plans and tables of engineering calculations the experience of recent years has been richly drawn upon.

The book is bound in green cloth, contains 64 pages, and sells for $1.50 a copy.

BRITISH COMMENTARY ON STRUCTURAL-STEEL WELDING

That structural-steel welding in England will keep pace with developments along the same line in other European countries seems to be a forlorn hope. The responsibility for this condition rests largely in certain laws enacted while structural welding was just budding into use as a tool, which acts were designed as a protection against the use of welds of unknown quality in places where their failure would be disastrous to life and property, but which laws are now a deterrent to the use of welding—good as well as bad—in structures which it has been proved can be welded successfully and safely.

Commenting on this condition, *The Welder*, published by the Alloy Welding Processes, Limited, in its March, 1930, issue, states:

"The most significant development in the welding world at the present time is the great interest which is being displayed by all countries in the welding of Steel Constructional Work. This country can again claim priority, in the welding of steel structural members and A.W.P. gains a considerable amount of satisfaction in being primarily responsible for the first all-welded steel building which was executed with A.W.P. materials and some of A.W.P. staff in 1921.

"Further progress was rendered impossible by reason of the Act of Parliament passed in 1909 entitled 'The London County Council (General Powers) Act 1909' and which expressly prohibited welding in structures of more than one story in height.

"In Germany the position has been somewhat similar to that which rules in this country; the laws having prohibited

the use of electric welding in the building industry; but laws in Germany seem to be much more elastic than laws in this country, and as a result, the Chamber of German Engineers has drafted regulations which have been passed by the building authorities and which have already come into force, with the result that structural-steel work in Germany can now be welded and it is only to be expected that the German industry will gain very considerably in consequence.

"In this country we have only arrived at the position of talking about the change in our laws. It was suggested many months ago that a committee should be formed to go into that matter in order to see whether fresh laws could be passed or amendments made in existing laws. It was not, however, intended that any hurried action should be taken, as the committee, it was suggested, should function for five years; and after the committee had duly deliberated and made their recommendations, we may expect that some move will be made, provided, however, that Parliament has sufficient time to allot to it, to consider some change. This may easily take another two or three years, so that in 1938 we may reasonably look forward to a revision of the laws relating to welding in connection with the building industry.

"In the meantime other countries will have had years of experience and in 1938 we may expect to be invaded with American and German constructional companies, anxious to show us, at our expense, how economy can be effected in our steel constructional work, and it is only to be supposed that for a considerable time afterwards we shall be favored with the services of American and German workmen, who will teach us the latest ideas that they have been able to evolve in connection with the work.

"When one contemplates a position of this kind, it is difficult to understand that we have something like one and a half million people unemployed."

BOOK REVIEW

WELD DESIGN AND PRODUCTION, by Robert E. Kinkead.

Advance notice of this book has been made under the title of "Safe Welds." The correct title is given above. This new book tells how to design safe and sure welds, how to control the manufacturing process to insure the production of the welds which have been designed, and how to predict and control the cost. It is primarily concerned with the above problems as they arise in using welding as a repetitive manufacturing process. However, some of the information on design—showing what happens inside the weld under practical service conditions—may be applied directly to repair work. The information will be of use to experienced manufacturing executives and engineers; and also to the practical operator who wants a better understanding of his job. An examination of the contents shows that it covers such subjects as Why Welds Are Made, How Welds Are Made, The Effect of Physical Conditions on Weld Behavior, Welding Procedure Control, and Machine Welding. Instead of showing pictures of welding equipment and of operators making welds and of finished work, the author has developed an ingenious method of showing sections of all kinds of welds under all kinds of conditions so that the illustrations are more in the nature of charts showing what happens inside the weld. There are 54 illustrations of this type. It is a 116-page book, well arranged and substantially bound. It is the sort of contribution to the literature of welding which one would expect of the author —Mr. Kinkead, who is widely known as one of the pioneers in the application of engineering principles to successful welding. For the past seventeen years his entire experience has been concentrated on welding research and practice, and since 1927 he has been in practice as a consulting engineer on welding.

This book can be obtained from the Ronald Press, 15 E. 26th St., New York City, or from the publishers of *The Welding Engineer*. The price is $4.00 per copy.

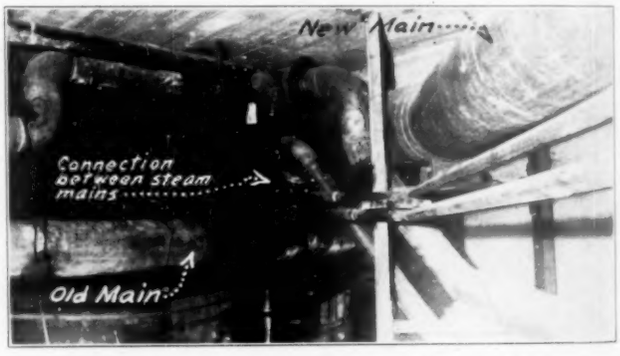
OFFERS PRIZE FOR PAPER ON WELDING

A prize of £10, 10s. (about $50), together with the gold medal of the Institution, is being offered by The Institution of Welding Engineers, a British society with headquarters at 30, Red Lion Square, London, W. C. 1, for the best original paper on either the oxy-acetylene or electric process of welding, offered by a bona fide welder. Applicants for the honor do not have to be members of the Institution. Each paper submitted must bear the title, "Welding Practices and Methods Based on My Own Eperiences," and must be received by the Institution not later than August 30, 1930.

AN INTRICATE TUNNEL PIPING JOB FACILITATED BY WELDING

When a tunnel for a steam main and other pipes to augment another tunnel already in service, was projected for a large manufacturer in Iowa, some difficult problems in pipe layout were met at the point where the new tunnel intersected with the old.

At this intersection a connection was made between the old steam pipe and the new, this being indicated in the illustration. This connection was readily made with the



Illustrating Welded Piping at Intersection of Tunnels.

welding and cutting torch, in a location where the two pipes are separated by only a few inches. A flanged connection at this point would have been impossible.

The new tunnel at this point makes a bend, and the direction of the steam main is changed by means of a welded bend in the pipe. Many turns were required in the smaller pipes in order to clear obstructions, and the making of these turns and jogs were facilitated by the welding in of Tube-Turns. In the illustration six or more Tube-Turns of various diameters are shown. The installation was made by the Moline Welding Shop, Moline, Illinois, under the direction of A. B. Gustafson. This shop has an enviable reputation in the district for successful handling of welded piping installations.

ARC-WELDED HOT HOUSES

The use of arc welding in the construction of hothouses is meeting with increasing favor among European construction engineers. This is indicated by the volume of business which has been developed in Germany in this field during the past few years. Customers of the Arcos Company, manufacturers of arc welding outfits, had constructed 12 large hothouses by the middle of 1929, comprising an average area of 294 sq. m. (3,165 sq. ft.) each. Twelve more hothouses were placed in service by the end of 1929, and twelve more are to be built in each of the years 1930, 1931,

and 1932, as contracted for, with others likely to be added.

The welded hothouse affords the entrance of more light, as compared with the riveted hothouse. In addition, the welded structure is more rigid, assuring longer life to the roofs and keeping the joints at the glass tighter, with less loss in heat. The structure of the welded hothouse differs materially from that of the riveted hothouse. The design of the supports is quite different, effecting a saving in weight of the metal work of at least 26%. Considerable labor is saved also. The welding is done in the shop, where the pieces of the supports are assembled upon a simple jig constructed of a few boards and provided with projecting nails. This quite primitive form works very well. After the various supports, sections of frames, etc., are welded in the shop, they are erected at the hothouse site and fastened together by means of bolts.

ALL-WELDED EXCAVATOR BOOM

When the Luke E. Smith Construction Co., engaged in a large drainage and construction job in northeastern Colorado, needed a new boom for one of the general excavators, electric welding came quickly to the rescue with the all-welded steel web boom shown in the illustration. This is believed to be the first web boom of all-welded construction

Electric Welding Was Used to Build This Boom.

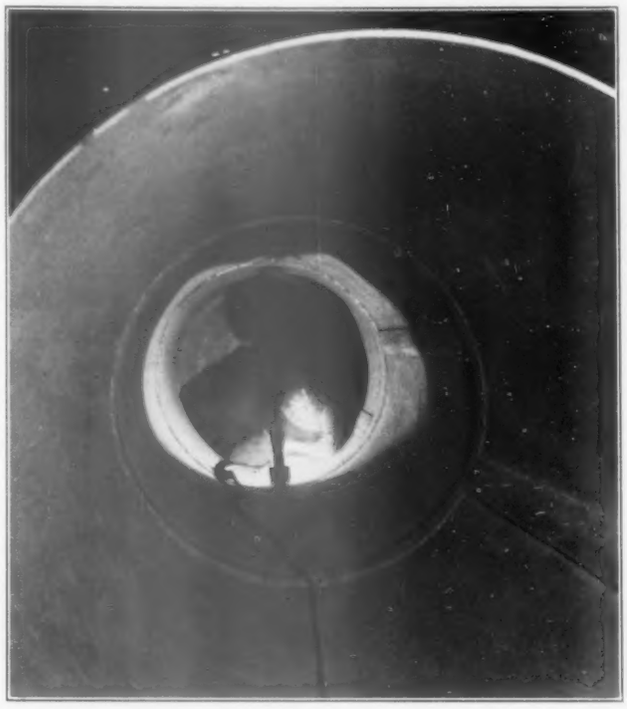
in the West, and was fabricated in the shop of the Smith Welding & Engineering Co., 1225 Twelfth St., Denver, Colo. Welding is frequently used by the Smith Construction Co. for quick time-saving repairs in the field.

PRESSURE TANKS HAVE BUTT STRAPS ON INSIDE

In the fabrication of a recent order of pressure tanks 4 ft. in diameter and 30 ft. long, built to withstand a working pressure of 150 lb., the Columbian Steel Tank Co., of Kansas City, Mo., used a continuous system of butt straps on the inside to cover each joint. The illustration shows the work in progress, and the location of the butt straps is clearly seen.

While actual break tests made in the plant of the Columbian Steel Tank Co. have shown in many instances that the weld is as strong as the steel in the tank, it was the opinion of the engineers that by adding the wide continuous butt strap in work of this kind, the margin of safety is moved up several hundred per cent.

The sheets after being cut to proper dimensions and shaped to form are tacked into position by tack welds a few inches apart, after which the welds are completed first on the outside, then with the butt straps on the inside. Pressure tanks are often assembled with rivets and finished by welding, but the rivets merely hold the sheets in place for finished fabrication, and the method just outlined makes it



View of Welder Working Inside of Tank.

unnecessary to depend upon rivets at all. This, of course, is an advantage because welding requires comparatively little outlay of capital for equipment, and the shop using the all-welded method has a strong advantage in competition. It is the opinion expressed by the above firm that for any one to claim greater strength by any manner of riveting than can be obtained with the construction illustrated seems to be a matter of backing a lost cause.

UNDERWATER CUTTING IS SUBJECT AT NEW YORK SECTION MEETING

"Cutting Steel Under Water" was the subject of the monthly meeting of the New York Section of the American Welding Society, held May 20th. The attendance was well over one hundred, and an animated discussion followed the presentation of the papers.

Commander Edward Ellsberg, who was awarded a Distinguished Service Medal by President Coolidge for the successful raising of the United States Submarine S-51, opened the program with a presentation of the problems involved in developing a thoroughly reliable torch for cutting steel under water. The torch developed, now known as the Ellsberg Model S-51, has been in use on numerous industrial projects for over three years.

This was followed by a two-reel motion picture depicting graphically the various major operations entailed in the raising of the U.S.S. S-51, including the sinking of gigantic pontoons, dredging under the keel of the boat, rigging the pontoon chains, and, finally, bringing the submarine into drydock at the Brooklyn Navy Yard.

The final paper of the evening covered "Industrial Projects on Which the Ellsberg Underwater Cutting Torch Has Been Used," and was presented by Charles Kandel, General

Manager, Craftsweld Equipment Corp., New York City. This paper, profusely illustrated with over fifty photographs projected on the screen by means of a reflectoscope, covered numerous projects located in various parts of the country. It included a demonstration of the dressing of a diver for his work, an analysis of the various problems entailed in this class of work and an exhibition of the actual equipment used, including several Ellsberg torches, manifolds, a powerful submarine searchlight, and a balanced high-pressure dredging nozzle.

In 1929 the Ellsberg torch was used for cutting over 600 tons of steel located at various depths up to 100 ft., consuming about 300,000 cu. ft. of oxygen and hydrogen in these operations. Among the more important projects were the following: Cutting sheet-steel piling used in cofferdam construction; cutting 48-in. girders forming the bottom of a steel caisson; cutting a 90-ton section of a sunken hull obstructing a navigable channel; and cutting steel grillage and supporting frame work in the reconstruction of the screens at the inlet of a large hydro-electric power plant. A number of well-known concerns have used this service.

It was brought out that a complete unit for these operations (with the exception of the diving rig) can be readily carried in two hand bags. It is available at short notice, including the services of an expert diver and skilled tender, for any operation, requiring only ordinary oxygen and hydrogen gases in cylinders and a supply of compressed air for its operation. This equipment and the method of operation have been materially perfected and today the cost of cutting steel under water has been reduced to less than one-half of the cost prevailing less than three years ago.

Knoxville Welders Are Taking a Keen Interest in Schooling.

NIGHT SCHOOL PROGRAM GETS BIG RESPONSE FROM KNOXVILLE WELDERS

Starting May 5th, the Burdett Oxygen Co., of Chattanooga, put on a night-school welding course covering a two weeks' period, to which welders and welding supervisors in the Knoxville territory were invited. Some idea of the popularity of the program may be obtained from the fact that the average attendance was around 200 at each session. There were 165 enrollments the first night and the total number of enrollments was 243. A large attendance at each session indicated that the interest was maintained throughout the program, one industrial company having 40 men in attendance every night. The first eight nights were devoted to lectures and demonstrations by S. H. Jones, Service Engineer of the Burdett Oxygen Co., of Chattanooga, which is a unit of Compressed Industrial Gases, Inc., with headquarters at Chicago. The first evening was devoted to a discussion of gases and to the requisites of welding. The lectures and demonstrations on the next seven evenings covered steel welding, cast-iron welding, aluminum welding, brazing, and hard facing. As these separate applications of welding were taken up, the discussions covered the nature of the metals used, methods of preparing for welding, selection of materials, and the most important applications. There would be an open class discussion following the lecture and then practice in torch work by the class, eight welding tables being provided. The classes lasted from 6:30 to 10:00 o'clock every evening.

On the next to the last evening, G. F. Sherman, of Tube-Turns, Inc., Louisville, Ky., gave a lecture on Tube-Turns, and the three motion-picture films of the Gas Products Association, including film No. 3 on pipe welding, were shown. On the last evening there was a lecture entitled "Welding and Its Future," by Thomas M. Sterling, power-plant engineer of the University of Tennessee. This was followed by the hydraulic test of a welded 4-in. pipe coupon which stood 4,500 lb. pressure without showing any defects in the joints. The evening closed with a social hour and the serving of refreshments.

This interesting educational effort was conducted by M. E. White, District Manager of the Burdett Oxygen Co., of Chattanooga, with the assistance of S. H. Jones, Service Engineer.

In addition to the large attendance there were other indications of the fact that such educational programs are very valuable to people interested in welding. The city Supervisor of Schools was so impressed that he spoke of the possibility of opening a night school for welding to cover a period of six months, starting with September; also a large industrial concern made a request that a two weeks' night school be conducted in their plant for the benefit of their own men. The accompanying photograph was taken while one of the classes was in progress.

Hints for the Welder

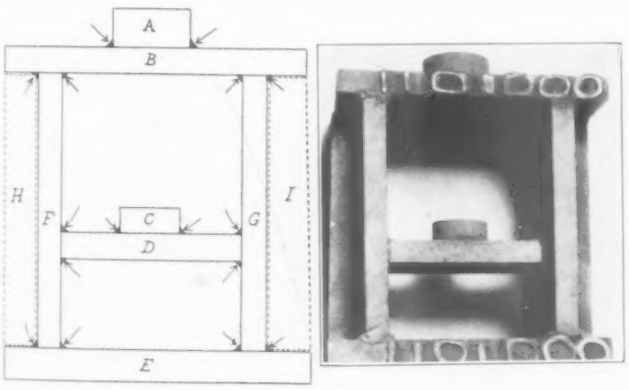
WHEN YOU FIND a new way to do a hard job, or finish a particularly interesting weld, can you describe how the work was done? . . . . . Have you learned some little stunt every welder ought to know? . . . . . Write to us about these things . . . . . This department helps you welders to help each other. Write up your ideas any old way and just make rough pencil sketches . . . . We'll fix them up for publication.

WELDING AND HARD FACING MAKE A BETTER JIG

By Geo. T. Kerr,

McIntyre & Kerr, Berkeley, Calif.

The illustration and drawing are of a jig for locating a reduction-gear housing for the drilling and reaming of a 1.3745-in. hole. The entire jig is fabricated from standard steel bar stock and pieces cut from standard steel plate. The cutting was done by means of a Davis-Bournonville shape-cutting machine, tracing directly from the detail drawings. The cut shapes were made full scale and sufficiently accurate for this purpose, thus saving layout time and resulting in a clean-cut job free from the usual rough



A - 3" O.D.
B - 1" plate 12" × 9½"
C - 2½" O.D.
D - 1" plate 7" × 4¼"
E - 1⅛" plate 12" × 9½"
F and G - ⅞" plate 10⅛" × 9½"
H and I - ¾" plate 10⅛" × 1⅝"

All-Welded Jig for Drilling and Reaming a Reduction-Gear Housing.

edges found where the cutting torch is manipulated by hand. The machine torch also saves 90% of the machining ordinarily required.

On this particular jig, hard faces were required on two opposite sides. The usual method in this case would be to screw hardened and ground strips to the jig, which would require at least four hours, and the danger would ever be present of the screws becoming loose and dirt working between the jig body and the hardened strips in service, causing inaccurate or spoiled work.

As some one has said, "The way to handle a job is to plan out the number of ways it can be done, decide on the best way, and then do it." We did that in this case, deciding on a Stoodited surface. The Stoodite facing was laid on as shown in the illustration, allowing plenty of room to drill and tap for screws. Then the whole piece was normalized and machined to the blueprint specifications.

By using Stoodite instead of screwing strips on in the accepted manner, we saved approximately 5½ hr. of time at $2.50 per hour, or $13.75. The value of the materials used was approximately the same in either case, as strips and screws would weigh three to four times as much as the Stoodite used. Furthermore, the element of time before the tool can be put into service should be given consideration.

Quite general use is being made of hard surfacing material and in many cases soft facing, such as phosphor or Tobin bronze, for bearing surfaces where space will not permit the use of bushings, or screws cannot be used to put on pads.

LEARN TO WELD RIGHT WAY AT START

By R. C. Leibe

This story is related for the benefit of the beginner in welding. It is intended to illustrate the value of learning the right methods when new at the business rather than having to learn all over again to make good welds. Mr. Jinks, who operated a repair shop for automobiles and light machinery, purchased a welding outfit. Jinks never believed in book instructions, preferring to learn the welding business without a teacher of any kind. He visited a neighboring shop and observed the welder make a minor weld, and went forth "knowing all that was to know." His welds gave trouble from the beginning, but he always came back with the remark to his customers that any material that "broke once is just as likely to break again." He excused his poor work in that manner and his customers fell off in numbers. Meantime he was teaching his young helper to weld his way.

But the assistant went a bit further into the science and read a few pamphlets on the subject. His work proved much better than that of his teacher's, yet gave trouble at times. This young man, after learning the business fairly well, went into business for himself and had fair success, and yet his welds on the whole were far from satisfactory. The young man hired an assistant and proceeded to teach him the art of welding. However, after a time, the assistant became satisfied with his progress and with his teacher and, looking over the trade-journal field, was advised by a friend to subscribe to *The Welding Engineer* which contained articles helpful to the welder as well as keeping one in touch with the progress in welding equipment and new methods. The assistant did this and quickly found out from experts through their articles and illustrations that he had learned wrong, that his boss was welding wrong, and, tracing their methods back to Jinks, that the three of them were making poor, weak welds that lacked penetration and resulted in breakage.

The assistant soon learned the inside facts of welding with the aid of his welding journal, and his reputation spread throughout the manufacturing section in which he lived, and his shop had to be enlarged to take care of the work. Poor old Jinks could never understand the reason for his failure, and finally gave up welding for other work. The

writer, having observed breaks in welds coming from Jink's shop, could easily see why they were weak. They were what might be termed "surface welds"—that is, the skin of a casting was welded perfectly all around while the center was untouched. On the other hand, a few welds coming from the successful welder was tested by breaking them in or near the weld, and showed that the metal was welded through and through, with not the least appearance of a break. This welder's former boss, realizing he had been taught wrong by Jinks, went through the job of learning all over again with the aid of his assistant who had learned the proper methods of the business from the teachings of the welding experts who furnished their experiences to the welding journal.

The writer admits a similar experience was passed through by him as a beginner, and it remained for this same welding journal to come to the rescue. The journal is like a set of lessons; it illustrates and explains fully problems touching on preheating, large castings, piping, the use of gas and electric outfits, proper rods and flux for certain jobs, etc., and the advertisements alone furnish valuable information to the welder. Only in this way can the welder learn of the many new devices and improvements in outfits.

The writer has often answered the fellow who condemns welding as a means of repair or replacement of parts by handing him a copy of *The Welding Engineer* and asking the doubting Thomas to behold the many things being done with the welding torch and arc.

The welding art has proved its merit both in saving money on replacement parts and in saving valuable time that would be required to order parts. For instance, a nearby manufacturing plant had some parts in their power plant broken. On wiring for these parts at the factory, they learned they could not obtain them before two weeks, owing to their steam engine being an old model and no parts being in stock. The welder was consulted, and he made the repairs, as good as new, in a few hours.

That factory was booked for many rush orders that must be filled at once or be canceled. A hundred laborers depended on the plant for their living. These were just a few of the things at stake, and a shut down for two weeks would have had serious consequences. The welding torch proved its value in this case.

The welder runs up against many problems—some of a very unusual nature. The operator of a certain welding shop related that the most difficult job he ever came in contact with was the welding of a "chilled plow" or moldboard. This is chilled, and hard as glass, and its surface is all curves and twists. Ordinarily, when welding one edge of the break, expansion causes the other surface to crack. Uneven expansion causes more cracks. The nature of this chilled metal and its shape in general makes it a case requiring extreme preheating for a successful job. It must be brought to a red heat throughout to weld. In this case the proper method of preheating was learned by turning to the pages of *The Welding Engineer*.

SILVER SOLDERING OF STAINLESS STEEL

By J. T. Loy,

Handy & Harman, New York, N. Y.

A special silver-solder formula known as "SS" has been developed for joining stainless steels and has been found to work quite advantageously.

This composition melts at 1,435 deg. F., but will not join the stainless-steel parts until a temperature of about 1,550 deg. F. has been reached. This naturally causes about 115 deg. of superheat in the solder. However, this superheat results in even a more complete fusion between the silver solder and the stainless steel, making strong, sound joints.

Silver soldering is a simple operation, but care should be exerted not to neglect any part of the process. Surfaces must be perfectly clean, having all dirt or grease removed either mechanically or chemically. The parts should be well fitted. Only a thin film of silver solder is needed and to use it as a filler is wasteful.

Proper fluxing is important. Plenty of flux should be used. Oxides form rapidly on stainless steels and are hard to remove. A paste composed of 1 part boracic acid and 1 part borax with zinc chloride makes a very satisfactory flux. All surfaces should be well covered as well as the solder itself. This procedure protects the parts against oxidation, absorbs oxides while soldering, and aids the flow of the solder. Brushing tends to spread the flux more evenly than dipping.

When expertly handled an oxy-acetylene torch is usually best. The flame is intense, however, and must be kept in constant motion. For delicate parts an oxygen-and-gas or gas-and-air torch will give good results. Either of these may also be used on big parts. The operation will take longer in preheating, but there will be less danger of melting the parts.

In preheating the joint and surrounding metal, the torch should be regulated to a slow flame to prevent blowing off the flux. Preheating around the joint limits heat radiation away from the joint itself. When the joint shows a dull red, concentrate the flame at full pressure along the joint, judging temperatures by color.

A good color guide to temperature is:

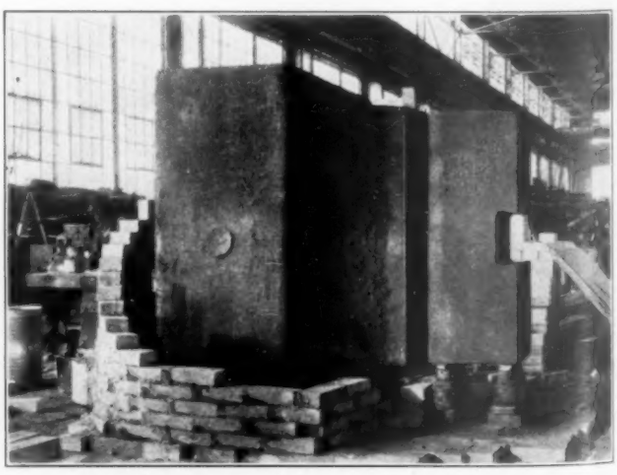
First visible red	900 deg. F.
Dull red	about 1200 deg. F.
Cherry red	about 1400 deg. F.
(Borax becomes fluid at about 1400 deg. F.)	
Bright cherry red	about 1600 deg. F.

When the stainless-steel parts reach about a bright cherry red, bring the silver solder under the torch flame. Then if the parts have been properly cleaned, fitted, fluxed and heated, the silver solder will flow quickly along the joint as though mechanically pushed.

Stainless-steel parts that are intricate in design, making proper fitting hard to control, or very thin parts should be properly jigged. Heavy parts should be well protected from drafts to prevent heat radiation away from the joint, which makes proper joining impossible.

HUGE STEAM-HAMMER ANVIL REDESIGNED AND WELDED FOR SEVERE SERVICE

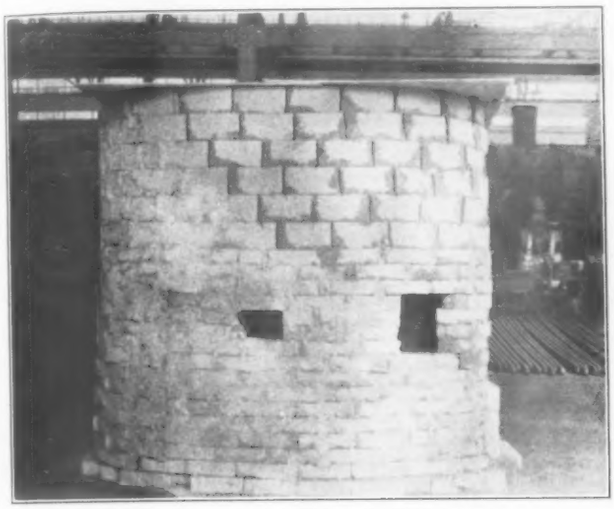
An 18-ton cast-iron anvil for a steam hammer had been subject to cracking near the top. To affect a permanent repair, it was finally decided to cut off the top of the casting and replace that part with a steel block bronze welded



Preheating Furnace Being Built Around Anvil.

to the remainder of the casting. The steel block was 42 in. long by 18 in. high and 19 in. wide.

The casting, with the top cut away, was laid on its side on the floor of the shop, with the steel block set in its proper position with respect to the casting. Then a preheating furnace was built around the casting, which was of much larger size than the steel block, and the casting was

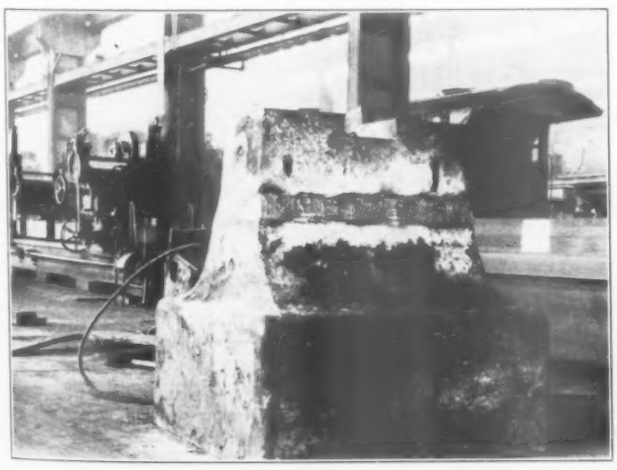


View of Completed Furnace.

heated with charcoal bricks, or charquettes, and coke. The furnace was covered with asbestos sheets to retain the heat. Data on time and materials used are as follows:

Labor—	
Setting up and building brick furnace	26 man-hr.
Sandblasting	3 hr.
Preparation (total)	32 man-hr.
Operating torches (2 at 15 hr. 45 min. each)	31½ hr.
Welding (total)	103 man-hr.
Welding Metal and Flux Used—	
Bronze rod	835 lb.
Flux	16 lb.
Gas Consumption—	
Oxygen	2,700 cu. ft.
Acetylene	2,750 cu. ft.
Fuel Consumption—	
Charcoal bricks	600 lb.
Coke	300 lb.

This is anexcellent example of where redesign and welding have been used together to advantage. Without the substitution of steel, with its elasticity and toughness, for



Anvil With Steel Cap Bronze Welded On.

the brittle cast iron on the top of the anvil, repairs would have been frequent because of the inability of the cast iron to withstand the pounding of the hammer for long periods without cracking. Then bronze welding was chosen as the means for making a permanent joint between the steel block and the cast base that would withstand the rigors of steam-hammer service. A joint that would not stand up would nullify the sole reason for capping the anvil with a steel block, which was to make a permanent repair.

BRONZE USED IN INSTALLATION OF CAST-IRON WATER MAIN

Bronze welding was used to solve a maintenance problem in connection with a recent installation of an 8-in. cast-iron water main in St. Paul, Minn. The pipe line crosses the Fort Snelling Bridge and is to supply Fort Snelling with water.

For many years cast-iron pipe has been used for water mains because it does not deteriorate in service. However, there had always been some difficulty in securing a permanently leak-proof joint between sections of pipe until the problem of making a satisfactory bronze weld for this purpose was solved. The joint difficulty in the case of water mains may be of minor importance under ordinary conditions; but when the pipe line is laid on a steel bridge, the vibration of the whole structure under the impact of traffic is, of course, transmitted to the joints; and if mechanical joints are used, they require considerable attention to prevent serious leakage. Furthermore, on account of the liability of freezing in the winter time in the northern climate, this pipe line had to be installed, a fact which increases the expense of repairing leaky joints. It was therefore decided to use bronze-welded joints as much as possible for that part of the line which crossed the bridge, although the underground sections of the pipe were connected by mechanical joints.

The pipe was delivered to the job in 32-ft. sections, each section being made up from two 16-ft. lengths which had been bronze welded together at the pipe manufacturer's plant. This, of course, reduced the number of similar joints which had to be made at the point of installation and cut the required construction welding time in less than half, thus making possible the minimum interference with traffic over the bridge. The joint used was the shear V design, which tests have shown is capable of developing the full strength of the cast iron. Three of these 32-ft. sections were bronze welded to form a virtually jointless cast-iron tube about 100 ft. long on the bridge.

Since the water passing through the insulated pipe line is to remain at nearly the same temperature throughout the year, and since the temperature of the steel bridge will vary over a wide range between winter and summer conditions, some provision had to be made for the relative expansion and contraction of the bridge and the pipe. The long welded sections are therefore joined with couplings to provide the slight flexibility and movement necessary. The pipe line is also supported at intervals on rollers to facilitate the movement.

Another point that had to be watched was the effect of the vibration of the bridge under ordinary traffic conditions. It was felt that since the welds were relatively weak while they were being made and before they had completely cooled, this vibration might be too severe and cause trouble for the welders. However, it was not considered necessary to close the bridge to traffic. It was simply slowed down while the work was going on. The strength of the weld when even a part of it had cooled was demonstrated by a slight accident which happened while the work was in progress. A half-welded 100-ft. length was jarred off from its temporary support, and fell, striking a heavy steel block. The great shock of this blow and the weight of an overhanging 32-ft. section concentrated on the half-finished joint broke out a good-sized piece of cast-iron piping without fracturing the joint itself. In fact, part of the weld had to be melted out so that the ends could be completely sepa-

rated for cutting off the damaged portion preparatory to rewelding.

Considerable interest was shown in this job by engineers in the St. Paul district, and it is thought that other local applications will be found in the future. The Arnold Construction Co., of St. Paul, had the general contract for the complete installation, and the welding on the bridge was done by the Flour City Oxweld Co.

WELDED WATERWHEEL RUNNERS INCREASE POWER OF OUTPUT

At a meeting of the N. E. L. A. Hydraulic Power Committee, held in Chicago last March, Prof. G. Brown reported results of an investigation of welding waterwheel runners. In the course of this investigation, it was found that restoring runners to their normal condition frequently increases their output on the same volume of water from 2% to 5%. The cost of welding was said to be approximately five dollars to six dollars per pound of metal deposited.

FLASH WELDING AUTOMOBILE FELLIES

By Albert Dambek

In order to secure welding of fellies of smaller thicknesses on an electric butt welder, the flash welding method has been adopted, for which the usual type of butt-welding machines with straight direction of the moving platen was used. When flash welding a ring-shaped piece, such as a felly, on a butt welder with a straight-line movement of the platen, the finished work shows certain inaccuracies which in most cases necessitate redressing.

To overcome this disadvantage, a large German firm has built a special machine in which the path of the moving platen is circular, so the edges of the ring-shaped object to be welded approach each other along the arc of a circle. Fellies welded with this machine show such an accurate jumping of material that the finished product is truly circular in form, even at the point of the weld.

The felly is inserted into the machine by hand and removed by hand, all the other operations being automatic. The machine is driven by a 1.2-hp. motor; the material is fitted into clamps by means of compressed air at 75 to 100 lb. pressure; the special transformer used has a capacity of about 80 kva.; and the flashweld of one felly requires about 0.2 kw.-hr. The welds show as much strength as the parent metal, and their malleability is somewhat less. Only a very slight jumping-line is obtained, and this is easily removed.

When welding fellies having a cross-section of between 0.6 and 0.75 sq. in. and a diameter of about 16 in., this machine executes a complete cycle of operation in 15 sec., of which the actual welding time takes about 9 sec. When provided with equipment allowing non-stop operation, it is estimated that 150 fellies can be welded per hour. Such equipment would take the place of the usual foot lever which is depressed to start the machine after the fillet has been inserted for welding.

WELDERS EMPLOYMENT SERVICE FOR ST. LOUIS

A new type of employment service for the welding industry has been organized in St. Louis. It is known as the "Welders Employment Service," with offices at 3031 Locust Blvd., St. Louis, Mo. W. D. Patterson, who was appointed secretary, is exceptionally well qualified to handle this work, as he has had seven years' experience in the welding industry, including five years practical welding and about two years as welding foreman.

This employment service was started because of numerous expressions from leaders in the welding industry for an organization where thoroughly competent welders could be obtained and where there would be no question as to the ability of the applicant to capably handle the particular kind of work required by the company employing him. All requests for welders are handled promptly.

Mr. Patterson states the new service is being received very enthusiastically by the employers of welders in the St. Louis and surrounding territories. In the past it has been very difficult for the companies employing welders to be sure of the capability of the man being employed. This difficulty has been considerably greater for the new users of the welding process.

Under no circumstances is an applicant for a welding job sent out until he has been thoroughly tested and has proved his capability to handle the work he is to do. Capable welders in the St. Louis territory are catalogued, showing places they have previously been employed, where they are now employed, and when they will be available for another position.

Each welding job that comes in is handled individually. Applicants are tested for their ability to choose the proper materials to use and to operate properly oxy-acetylene equipment or electric welding equipment, according to the job in question; their welding work is tested for tensile strength, whether or not the welds are porous, burnt, or leaky; and the completed job is judged from appearance as well.

Mr. Patterson also states that about one out of seven applicants proves to be qualified to do the work creditably, which definitely proves that there is a large field for this kind of work.

EXPANDS LINE OF RESISTANCE WELDERS

The American Transformer Co., of Newark, N. J., announces that they are expanding their line of resistance welding machines, the program of extension being in charge of E. P. Larkin, a pioneer and authority in welding applications who is now associated with the company. Improvement in design with the purpose of eradicating present defects in machines and increasing the efficiency of welding operations, is announced as the policy. Cooperation will be extended to industries for the solution of any problems in electric welding and particularly in weighing the possibility of labor and other savings compared with amortization, connected load, and other fixed charges, which factor is very important and yet little understood.

DEVELOPS PROCESS FOR ELECTRIC WELDING OF LIGHT-GAGE MATERIAL

A new welding rod, known as "Lightweld," which can be used on material of 16, 18, 20, or 22 gage, in making a lap, butt, or corner weld, has been developed by The Lincoln Electric Co., Cleveland, Ohio. When used with a manual carbon arc and with from 30 to 60 amp. direct current, it is said to make a dense weld that is free from pin holes. It is suitable for horizontal, vertical, and overhead work.

This new rod is $\frac{1}{16}$ in. in diameter and 30 in. long, and is put up in 10-lb. containers. The carbon used with it should be $\frac{5}{32}$ in. in diameter and should be tapered gradually from a sharp point back about 1½ in., and should be gripped in the holder about 2 in. from the point. A head shield should be used by the operator so as to leave both hands free. The carbon in a holder should be held in one hand and the rod in the other.

The rod should be held directly over the seam with the end of the wire tight down against the sheet. The position of the other end of the wire should be fairly close to the work, so that the wire at the weld lies fairly flat and does not rise too abruptly from the weld; an angle of about 15 deg. to the sheet works very well. The carbon should be held at an angle of about 60 deg. to the sheet and pointed in the direction of the welding.

The arc should be kept at such length that there is a continuous bead of molten metal from rod to crater. A ca-

pacity of 100 amp. is desirable, although 200 amp. can be used and even a 300-amp. machine, provided stable currents are obtained at the low currents required for the proper procedure on "Lightweld." The setting on the machine should be such that the proper current is obtained with the highest open-circuit voltage.

Speeds of 7 to 18 in. per min. can be obtained, depending upon the type of joint, whether lap, corner or butt, the gage of the material, the setup or tightness of the joint before welding, and the skill of the operator.

Regular polarity should be used—that is, the work positive and the carbon electrode negative.

NEW HIGH STRENGTH ELECTRODE

The Koro Corporation, Waukegan, Ill., manufacturers of gas and electric welding wires, have recently put on the market a new welding rod which is called "Korod." This is a special analysis wire with a paste coating. The manufacturers state that the purpose of the new electrode is to allow relatively high-speed welding where high tensile strength is also a requirement. Tensile tests made on coupons welded with this material have shown over 73,000 lb. per sq. in. tensile strength in the weld metal. Another feature claimed for the rod is that it permits welding with a relatively large arc length, giving the operator more freedom in this particular and thus adding to the ease of welding.

WELDER OF COMPACT, STURDY DESIGN

An arc welder is being made by the Burke Electric Co., Erie, Pa., that has a welded steel frame, is splash proof, protected from external injury by being so designed that it is impossible for pieces of metal or other foreign matter to fall into the working parts, and is protected from the elements by the semi-inclosing case. Sparkless commutation is claimed for all ranges. This welder includes a motor starter and all other equipment to make it a complete unit in itself.

The control lever is readily accessible, so the welding current can be instantly adjusted to the most efficient value. The gradual control provides an infinite number of steps for current variation. The striking of the arc is always the same regardless of the current setting, and the welding arc has the same characteristics throughout the welding range. The generator is self-excited, the exciter being built into the machine.

When Burke engineers tackled the problem of designing an efficient arc welding unit, they used the knowledge gained in many years' experience in the design of motors and generators by the company. A compact, complete unit of unusually sturdy construction, which will require the minimum of maintenance expense, and can be used for all classes of arc welding, is the result of their efforts.

NEW REGO REGULATOR HAS TWO-STAGE FEATURE

During the current month, announcement was made by The Bastian-Blessing Co., Chicago, Ill., manufacturers of the "Rego" line of oxy-acetylene welding and cutting apparatus, that they are now in full production on the new Rego Red Star Duplex Regulator. Although hundreds of these regulators have been in service on various kinds of work for an extended period, including over a year and a half of service in a large automobile plant, public announcement was not made until this new type of regulator had had a complete workout under a variety of conditions and production facilities arranged for turning them out in quantities to meet all demands of the industry.

For many years The Bastian-Blessing Co. has listed in its catalogue a two-stage regulator, which consisted essentially of two complete regulators connected together. This combination was often in demand where the requirements were for great precision in the regulation of the working pressure. The new Red Star model combines the two into a single unit and at the same time embodies other interesting features. The entire mechanism is enclosed in a circular case, and consists of a first-stage regulator designed and constructed to perform in perfect balance with the precision regulator used for the second-stage. Both stages are governed by regulators having large-sized diaphragms and functioning at any desired pressure. The jarring of the second-stage adjustment screw out of position

Rego Red Star Duplex Regulator

by the vibration of adjacent machinery is prevented by a simple lock nut. Both adjusting screws have hexagonal handles.

The manufacturers state that the new regulator has also been designed so that it not only can be used for both welding and cutting, but that both operations can be done simultaneously. A separate high-pressure outlet with a needle valve is provided on the first-stage line. When the operator does not need his cutting torch, he simply closes this needle valve.

The inlet connection is designed as a simple, removable joint so that no special tools are needed to take the regulator apart or put it together, and valve seats are placed so as to be easily reached from the outside.

The body of the regulator is made of a new alloy which has a tensile strength of 55,000 to 65,000 lb. per sq. in. and weighs only about one-third as much as brass. The result is a light, compact construction which minimizes the weight and consequent strain on the valve stem. The gages are set within the body, and the entire regulator hugs the tank closely. An automatic safety outlet releases any abnormal or excess pressure which might be caused by accident to any part of the equipment.

Credit for the development of this regulator is given to Chas. L. Bastian, president of the company, who has been

known for many years as an authority on the construction of high-pressure gas-regulating apparatus.

The Red Star line includes five types of regulators, one of them for oxygen, two for acetylene, and two for hydrogen. All of them carry a two-year guarantee.

NEW BUTT WELDER ANNOUNCED BY MICRO PRODUCTS

A circular recently published by the Micro Products Co., Peoria, Ill., illustrates and describes a new model of Micro butt welder which has been developed for handling heavier work than can be handled efficiently on the smaller machines. This new butt welder is said to have a sufficient capacity for butt welding all shapes from ¼ to ⅝ in. size. An index barrel enables the operator to set the proper spring tension for any certain size of stock. The clamps and dies are designed to insure tight closing on the work. The operating switch is made on the same plan as in the model E machine described in a previous issue of *The Welding Engineer*. The clamps are controlled by handles; the clamping arrangement enables the operator to set the work in

Butt Welder for Metal Parts ¼ to ⅝ In. Thick.

position quickly, and the heating switch allows the use of three heats, according to the size of the stock. The machine can be used for annealing high-carbon stock by equipping it with annealing dies. This model can be used on a bench or can be furnished mounted on a truck for easy portability. All working parts are enclosed, and the manufacturers state that there is very little servicing required to keep the machine in working condition.

NEW STOODY ELECTRODE HOLDER

The Stoody Company have placed on the market a holder for electric-welding electrodes which is quite promising in design. The completed holder weighs but one pound and one ounce, yet it is constructed of steel forgings with a turned composition fiber handle.

The method of attaching the conductor cable to the holder is unique, in that it requires no sweating in or soldering, and yet the cable is firmly attached and an excellent electrical connection is always insured.

The jaws which hold the electrode are corrugated; each of the three at a different angle, so that the electrode may be tightly held at any working angle.

The holder arms are made of a special alloy steel and are nickel plated and buffed. The spring tension is such that any electrode from ⅛ in., or less in diameter, to 5/16 in., or more in diameter, is held by the same tension. The

Light-Weight Electrode Holder With Narrow Jaws.

spring action occurs on a radius of approximately 18 in., so that the holding jaws remain parallel, regardless of the size of the electrode used. The tension pressure extends through the entire length of the prongs.

One of the principal features of this holder is the narrow jaws which permit using the electrode up to less than 1½ in. in length, and this bit of unused electrode falls out as the new electrode is inserted.

"WAVERLESS FLAME" SAFETY FEATURES

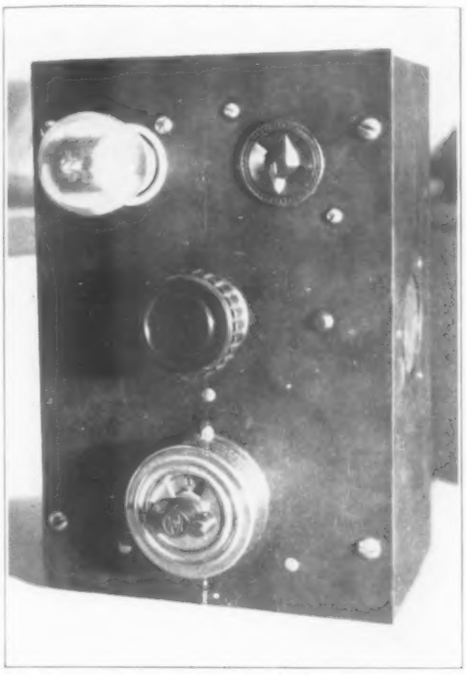
The K-G Welding & Cutting Co., Inc., recently put the "Waverless Flame" Oxygen Regulator on the market. The company claims that this regulator, besides having all the operating advantages claimed for the double reduction of the initial pressure, offers interesting safety features. The unsafe practice of not having the adjusting screw released before opening the cylinder valve, which is the acknowledged cause of most of the oxygen regulator accidents, is always present in the first stage. However, by the construction of their first stage they are able to make use of a metal seat. The initial high pressure of the cylinder is reduced to 250 lb. at the first-stage stem and seat, which has the adjusting screw at all times screwed in and is not released at any time, so that with the metal seat employed no damage from the high heat of the sudden compression or friction can result. The use of the metal seat is claimed to be an exclusive feature of the K-G Regulator and separate attachment. Another feature claimed for the valve is that the smallness of the diaphragm plate gives a maximum of only 600-lb. pressure in the expansion chamber of the first stage with a fully charged oxygen cylinder. The first stage of this regulator is manufactured as a separate unit and can be applied to any make of regulator.

ELECTRIC-SOLDERING-IRON CONTROL

Quick heating generally means excessive heating in the usual electric soldering iron, and excessive heating means premature burning out of the heating element, as well as frequent cleaning of the tip. While the quick-heating feature is desirable, it is necessary to reduce the amount of current supplied to the iron once it has become heated, in assuring proper soldering temperature, minimum current consumption, and long and economical life for the iron itself.

A simple economical control for the usual electric soldering iron has been developed by the engineering staff of the Clarostat Mfg. Co., Brooklyn, N. Y. It comprises an iron box with the necessary knockouts for BX or conduit wiring, with a front metal panel carrying a switch, a knob controlling the soldering-iron temperature, a pilot light, and a receptacle to take the usual attachment-plug cap. The switch has three positions, namely: first, current off; second, full current on; third, reduced current on. To gain quick

heating, the switch is snapped to the full-current position. When the iron is heated, the switch is snapped to the reduced-current position, while the heat-control knob is set for any desired degree of heat, depending on the work to be done. The pilot light indicates whether the iron is on



Solder-Iron Heat Is Readily Controlled With This Panel.

or off. The device is provided with ventilation holes, and in every way complies with the underwriters' requirements.

It is claimed that the Clarostat electric soldering iron control will prolong the life of the usual iron at least six times. Furthermore, it effects a marked saving by eliminating frequent cleaning of the iron and by providing an iron that is always ready for use.

NEW GOGGLE BY CHICAGO EYE SHIELD COMPANY

The Chicago Eye Shield Co. recently put on the market a new model goggle known as the M & L. The purpose of these goggles is to furnish eye protection for welders who are already wearing spectacles to correct defective vision. The need, of course, is for a goggle which will fit over the glasses which are already worn. The new goggle mentioned above fits over all types of glasses, the construction allowing room for the temple and nose bridge and at the same time providing a snug fit around the eye. The frame is molded of a special material which is strong, light, and moisture-proof. Lenses are supplied for welders and also for those who use grinding and chipping tools. The nose bridge is of leather, easily adjustable as to size and readily replaceable. The goggle is equipped with a strong, serviceable head-band which has a new and convenient adjusting arrangement.

SOMETHING NEW IN CARBIDE LANTERNS

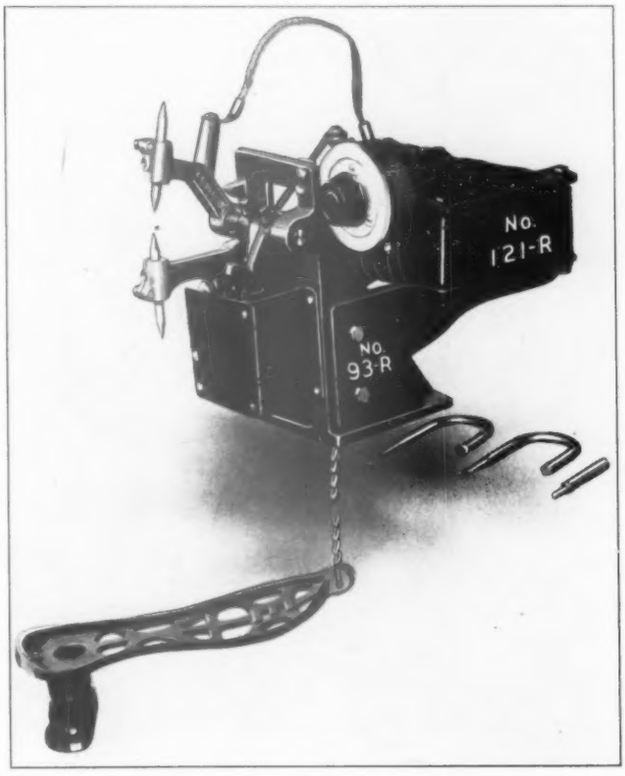
A carbide lantern embodying a double signal, which may be red or green or any other colors, has been designed by the National Carbide Sales Corp., Lincoln Building, New York, N. Y., at the request of a signal engineer connected with a large transportation system. The lens in the rear signal is said to make the color easily distinguished at a long distance, thus giving warning to the engineer or motorman of an approaching train in ample time to prevent an accident. Another valuable feature from the standpoint of safety is that the double rear light can be changed quickly from red to green or back to red; hence the lantern can replace any signal that is temporarily out of commission. The lantern throws a white beam of light averaging 75 to 80 candlepower over a period of 8 hr.

NEW LINE OF MILL-CUT BURS

A line of mill-cut burs in 14 new shapes, to supplement the regular line of ¼-in. and ½-in. file-cut burs made of special high-speed steel and the standard line of mill-cut burs, has been announced by The Keller Mechanical Engineering Corp., 72 Front St., Brooklyn, N. Y. Like the other Keller burs, these have a ¼-in. shank. Their diameter varies about ½ in. These burs are said to cut very rapidly, and they can be used on die steels, where they will leave a smooth finish. They may be used also on aluminum, brass, bronze, copper, and other soft metals without clogging, and can be successfully used on wood, plaster, leather and horn. They are made of one piece of steel, machined and milled between centers and ground after hardening. They are adaptable to all kinds of flexible-shaft equipment, portable drills, and stationary machines.

SPOT WELDERS FOR LIGHT WORK

An improved type of small electric welding machines for use in the manufacture of radio tubes, incandescent lamps, jewelry, metal novelties, and in sheet-metal work, wire welding, etc., has been placed on the market by the Eisler



New "Eisler" Spot Welder for Small Work.

Electric Corp., 744-772 South 13th St., Newark, N. J. With these machines wire or sheet stock as fine as 0.0005 to $\frac{1}{16}$ in. may be welded or fused together.

These machines are operated by means of foot-treadles. When the foot-treadle is pressed, the upper electrode moves down toward the lower electrode, which is fixed. In this manner the pieces to be welded are gripped in their proper position. On further pressing the treadle, contact is made,

causing the electric current to flow; the heat of the current is centralized at one point, making a fusion between the two pieces that are to be joined. Upon releasing the treadle, the upper jaw electrode returns to its original position. The complete welding operation takes but a few seconds. Various styles of jaws are employed, suiting the nature and size of the work.

These welders are said to be simple in design and well constructed, therefore requiring practically no service.

Examples of Various Types of Jaws for Different Work.

They are equipped with ½-kw. or 1-kw. transformers, depending on the nature of the work, and various degrees of heat can be obtained.

This type of spot welder weighs 37 lb. complete and requires a table space of 10x15 in.

NEW VICTOR REGULATOR BULLETIN

The Victor Welding Equipment Co., 844 Folsom St., San Francisco, Calif., have recently issued a newy bulletin describing and illustrating the Victor line of gas pressure regulators. This bulletin outlines the specifications of the Victor regulator, includes a cutaway view to show all the working parts, and illustrates the various types and sizes of regulators and adaptors.

PAMPHLET ON GEWECO "K" KUTTER

A new type of automatic shape-cutting machine known as the Geweco "K" Kutter, is shown and described in a mailing piece issued by the General Welding & Equipment Co., 70 Landsdowne St., Boston, Mass. This machine is made in three sizes, the smallest (No. 1) having a rectangular cutting range of 2 by 4 ft., a greater length of cut being possible by lengthening the machine. The next size, No. 2, has a cutting range 3 ft. wide and 6 ft. long, or any other length. The No. 3 machine will cut shapes up to 4½ ft. wide and 12 ft. in length.

PUBLICATION ON FLEX-ARC WELDERS

A description of Flex-Arc welding sets is given in leaflet 20390-B, issued by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Dimensions and ratings are given, and information is included on design, application, and the gas-engine power unit. Features of control and design are pointed out. Both stationary and portable sets are described.

"A VISIT TO ARMCO WITH THE IRON MASTER"

A very interesting illustrated booklet under the above title has been published by The American Rolling Mill Co., Middletown, Ohio. Here the talks by the "Armco Ironmaster," which were keenly listened to by many thousands in radio broadcasts, appear in printed form, and the booklet is being mailed to those radio listeners who have expressed a desire to preserve this simple narrative which pictures iron and steel making from the early ages to the present day. One of the episodes related by the Ironmaster is on "Welding." Others pertain to the various processes of manufacture of iron and steel, the part played by the chemist and metallurgist, how rust resistance is obtained, electricity in iron and steel research, sheet metal in home and industry, and Armco policies.

TO POPULARIZE AERIAL TRAMWAYS

That America will soon be using aerial tramways as a means of travel is indicated by an announcement made by the American Steel & Wire Co., 208 S. LaSalle St., Chicago, Ill., A really successful and efficient system of aerial tramways for passenger transportation in the United States has been made available by the appointment of this company as sole licensees in America of the Bleichert and Bleichert-Zuegg systems. This mode of travel, which has long been popular in Europe, makes readily available to the visiting public what would otherwise be inaccessible spots. It permits unrestricted vision and carries with it the thrill of passing through space at high speeds.

KEITH DUNHAM ON EUROPEAN TRIP

M. Keith Dunham, president of the Keith Dunham Co., Chicago, is planning to make an extensive European trip during the summer months. He will sail for Germany in June in time to attend the Acetylene and Welding Convention in Zurich, Switzerland, July 9th to 12th. His trip calls for tours through France and Germany to look after the business of the company in those countries, and it is reported that he will spend considerable time in England, where the Keith Dunham Co. has large interests.

TO DIRECT WESTINGHOUSE RESEARCH

L. W. Chubb, formerly manager of the Radio Engineering Department of the Westinghouse Electric & Manufacturing Co., and lately assistant to the vice-president of the Radio Victor Co., has assumed the position of Director of the Westinghouse Research Laboratories, which was left vacant by the promotion of S. M. Kintner to Assistant Vice-President. Mr. Chubb has made noteworthy investigations into the preparation and properties of magnetic steel, and on two occasions represented America in international electrotechnical conventions held in Europe.

PRESSED STEEL TANK COMPANY OPENS PACIFIC COAST OFFICE

Owing to a rapidly increasing volume of business on the Pacific coast, the Pressed Steel Tank of Milwaukee, Wis., has opened a Los Angeles office under the management of J. A. Barr, formerly connected with the Associated Supply Co. Mr. Barr will represent the company for all the Hackney products, such as steel drums with patented raised openings, seamless steel barrels, cylinders, shells, and special shapes. The new office is located at Room 459, Roosevelt Building, 727 West Seventh St.

TO SUPPLY WELDED CONSTRUCTION SERVICE

Announcement is made by Robert W. Wolcott, President of the Lukens Steel Co., Coatesville, Pa., of the entry of this company into the field of supplying welded steel construction to the manufacturers of machinery and equipment. Research and development work in this connection has been going forward for several months and approximately 50,000 sq. ft. of manufacturing space has been provided at the Coatesville plant for this activity.

Operations in this field will be carried on through a subsidiary company known as Lukenweld Incorporated, which

for the present will utilize some of the manufacturing facilities of the parent company.

Mr. Wolcott states that rapidly increasing demand on the part of machinery and equipment buyers for welded steel construction is responsible for the new development. An extensive program of development and research work has been laid out to assure the safety and economy of welded steel design. Engineering assistance will be furnished to users of this class of construction through a development and research division.

The new company has twenty-four operators working at the present time and expects to have fifty in production within the next sixty days. G. D. Spackman is president of the company.

TOPEKA WELDING SHOP HANDLES WIDE RANGE OF WORK

A newspaper clipping forwarded by a correspondent gives some interesting information regarding the activities of the Topeka Arc Welding Co., of Topeka, Kan. It is spoken of as one of the most complete and efficient welding plants in the district which enjoys a large patronage on account of its reputation for good work. Probably this is due to the skill and experience of C. L. Meinholdt, better known as "Shorty" by his customers, who is president of the company. Mr. Meinholdt believes in keeping his shop equipped

For Field Work This Truck-Mounted Acetylene Generator Comes in Handy.

with plenty of welding apparatus to handle all classes of work. He has seven oxy-acetylene welding outfits, four arc-welding machines, including a new 300-amp. machine which has just been added to the equipment. Another recent addition to the equipment is a 50-lb. acetylene generator mounted on a model A Ford truck. The concern makes a specialty of pipeline welding, but is fully equipped and organized to handle such work as oil tanks, underground tanks, structural steel work, boiler welding, and all kinds of commercial repair welding. They do a considerable amount of business in automobile work, particularly auto and truck frame strengthening.

NEW SWEDOX BRANCH IN LOS ANGELES

Announcement has been received that the Central Steel & Wire Co., Chicago, Ill., who manufacture a complete line of electric and gas welding wire, have recently established a branch at 912 E. Third St., Los Angeles, Calif. A. W. Courtney, who has been in the welding supply business in that district for a number of years, has been appointed manager of this branch. A complete stock of welding wire of all kinds and welding accessories will be carried by the Los Angeles branch so that immediate attention can be given to the shipment of all orders. The Central Steel & Wire Co. now have branches at Dayton, Ohio, Detroit, Mich., and Los Angeles, Calif., in addition to the main plant and general office at 4545 S. Western Ave., Chicago.

AMERICAN ROLLING MILL AND SHEFFIELD STEEL COMBINE THEIR INTERESTS

Negotiations for combining the interests of The American Rolling Mill Co. and the Sheffield Steel Corp. have been successfully concluded, it is announced. By this combination The American Rolling Mill Co. extends its line of products to include merchant bars, billet and rail steel reinforcing bars, bolts, nuts, rivets, spikes, tie plates, oilfield and railroad forgings and bar iron, barbed wire, and nails, and the company immediately begins production in Kansas City of blue annealed sheets. The Sheffield corporation already has two blue annealing jobbing mills in operation with a range of size up to 72 in. in width. The Sheffield corporation was formed in 1925 to acquire the Kansas Bolt & Nut Co., organized in 1888, and their plants, situated in East Kansas City, Mo., have a total annual capacity in excess of 200,000 tons.

EXHIBIT AT GEWECO PLANT

Developments in atomic-hydrogen welding, fabrication with shape-cutting machines, and metal coating, were demonstrated and explained at a meeting held at the shops of the General Welding & Equipment Co. at 70 Lansdowne St., Boston, Mass., on the evening of May 23rd. This meeting was held with the Boston Section of the American Welding Society, and with the Metals Coating Co. of America, Philadelphia, and the General Electric Co. cooperating. Short introductory talks were given by Dr. Leopold Pessel, of the Metals Coating Co.; S. Martin, Jr., of the General Electric Co.; and Dr. A. Krebs, of the General Welding & Equipment Co. The exhibits were open at 10 a. m. for the convenience of out-of-town visitors. A similar meeting was held by "Geweco" two years ago.

NEWS OF THE INDUSTRY

A new welding plant is being opened for business at 2904 Santa Fe Ave., Los Angeles, Calif., to be known as the Paulus Welding Works, with Walter Paulus as manager. The shop is equipped for general electric and gas welding, a new U.S.L. 300-amp. electric welder having just been installed with other equipment in the new shop. Mr. Paulus has had 24 years of experience in welding and has just recently moved to Southern California from Milwaukee, Wis., where he owned and operated the Good Welding Co.

The Austin Co., engineers and builders, have been awarded a contract to design and contruct a building to be leased to the American Tractor Equipment Co., Emeryville, Calif. The building will be used for welding and assembly of dirt-handling equipment for tractors. It will be of steel frame construction, 90 by 100 ft., and will be equipped with one three-ton traveling bridge crane. The total cost will be around $40,000.

The Western Pipe & Steel Co., of Los Angeles, Calif., are completing two large electric-welded absorption tanks for the Dry Ice Corporation of Los Angeles. The tanks are 14 ft. in diameter and 85 ft. high, and are all-welded throughout. These tanks are to be used in the manufacture of dry ice.

Appointment of six new distributors is announced by Tube-Turns, Inc., Louisville, Ky., manufacturers and marketers of seamless, short-radius forged fittings for pipe welding. The new distributors are the Grinnell Co., at Charlotte, N. C., for North and South Carolina and Georgia; the Ebbert & Kirkham Co., Inc., of Birmingham, Ala., for Alabama; the B. Hoffmann Manufacturing Co., of Milwaukee, for Milwaukee and adjacent territory; the United Pipe

& Supply Co., of Charleston, W. Va., for Charleston and adjacent territory; the Vulcan Copper & Supply Co., of Cincinnati, for Cincinnati and adjacent terrtory; and Hedley & Voisinet, of Buffalo, for Buffalo and surrounding territory. Each of the new distributors carries complete stocks of Tube-Turns. Almost every class of industry in this country is now using these fittings, making expansion of sales outlets mandatory, Tube-Turns, Inc., reports.

The Elliott Welding & Mfg. Co., Inc., of Anaheim, Calif., are erecting an all-welded steel structure as an addition to their plant in Anaheim. The framework is of discarded oil-well drill pipe, which, with the welded construction, will give great strength. The added space will be used in the construction of fuel-oil and gasoline storage tanks, the shop being high enough to allow working on a tank 20 ft. high. A new 300-amp. Westinghouse electric welder was recently added to the plant, and other new equipment is contemplated soon. Another product of the company is an all-welded steel body for meat delivery trucks, which, owing to its welded construction, adds a practical feature in that it affords a measure of cleanliness and greater sanitation. R. E. Elliott is manager of the company.

F. J. Giroux, formerly connected with Arcos, Incorporated, recently joined the staff of the Roessler & Hasslacher Chemical Co. at Niagara Falls, N. Y., as Welding Engineer.

J. S. Buck recently opened a welding and auto repair shop at Norwalk, Calif. General welding, repair work, and cylinder grinding will be featured in the new shop. Mr. Buck formerly operated a similar shop in Artesia, a neighboring town.

The Masters Welding Works, of Signal Hill, Calif., have reopened their shop at Englewood, Calif., owing to renewed activities in the oil field in that district. Recent inactivity of this field forced Mr. Masters to close his shop at that place. The shop, typical of all well-equipped oil-field welding shops, is fully prepared to handle all kinds of general oil-field welding, both gas and electric. Twenty-four-hour service is featured at all times.

A new welding and machine shop has opened for business at 1624 W. Main St., Compton, Calif. The shop is owned and operated by O. A. Cotton and P. S. Price, formerly employed by the Union Oil Co. in southern California. The shop, which is being fully equipped for both electric and gas welding, will be known as the Rite-Way Welding Co. General welding, brazing, and hard facing with special attention to brick-yard-machinery repair work, will be the main features of the new shop's work.

Thompson A. Lyon, for the past ten years Superintendent of the Davis and Hemphill Co., Elkridge, Md., manufacturers of screw-machine products, was recently appointed Plant Superintendent of the Alexander Milburn Co., of Baltimore, Md., manufacturers of oxy-acetylene apparatus, portable carbide lights and paint and lacquer spray equipment. Mr. Lyon brings to Baltimore a wide experience in mechanical engineering obtained in the past fourteen years since he graduated from the University of Maryland. He held the rank as Major in the 29th Division and served overseas in the World War, receiving recognition for two major operations and a division citation. Mr. Lyon is a Major in the U. S. Reserves and the National Guard.

The Ace Welding Works, of Santa Fe Springs, Calif., with D. W. Criswell as manager, have recently opened a branch shop in Venice, Calif. Twenty-four-hour service is being maintained with first-class electric and gas equipment. Venice is the center of considerable activity in oil development at this time. Mr. Criswell is also servicing and marketing at his Santa Fe Springs shop a new oil-well digging bit. The bit, which is of the expansion type, is the invention of Edward Neilson, of Whittier, Calif., and is designed for underreaming, etc. It will enter a 10⅝-in. hole and expand to 12¼ in. when on the bottom.

The Lincoln Electric Co., Cleveland, Ohio, announce the removal of their Baltimore, Md., distributor's office from 432 N. Calvert Street to 600 N. Calvert Street. T. A. Canty is in charge of distribution in this territory and announces also the appointment of R. Rude as office manager and C. N. Hilbinger as Sales Engineer and Service Manager.

The Co-Operative Welders and the Huber Manufacturing Co., of Signal Hill, Calif., have merged and formed a new organization to be known as the Huber Manufacturing Co., with headquarters at 1740 Loma Ave., Long Beach, Calif. The new company will feature all kinds of oil-field welding work, and also expect soon to be manufacturing and introducing a new type of oil-well core barrel. W. H. LeRoy, who is general manager of the new company, is well known in the Signal Hill field.

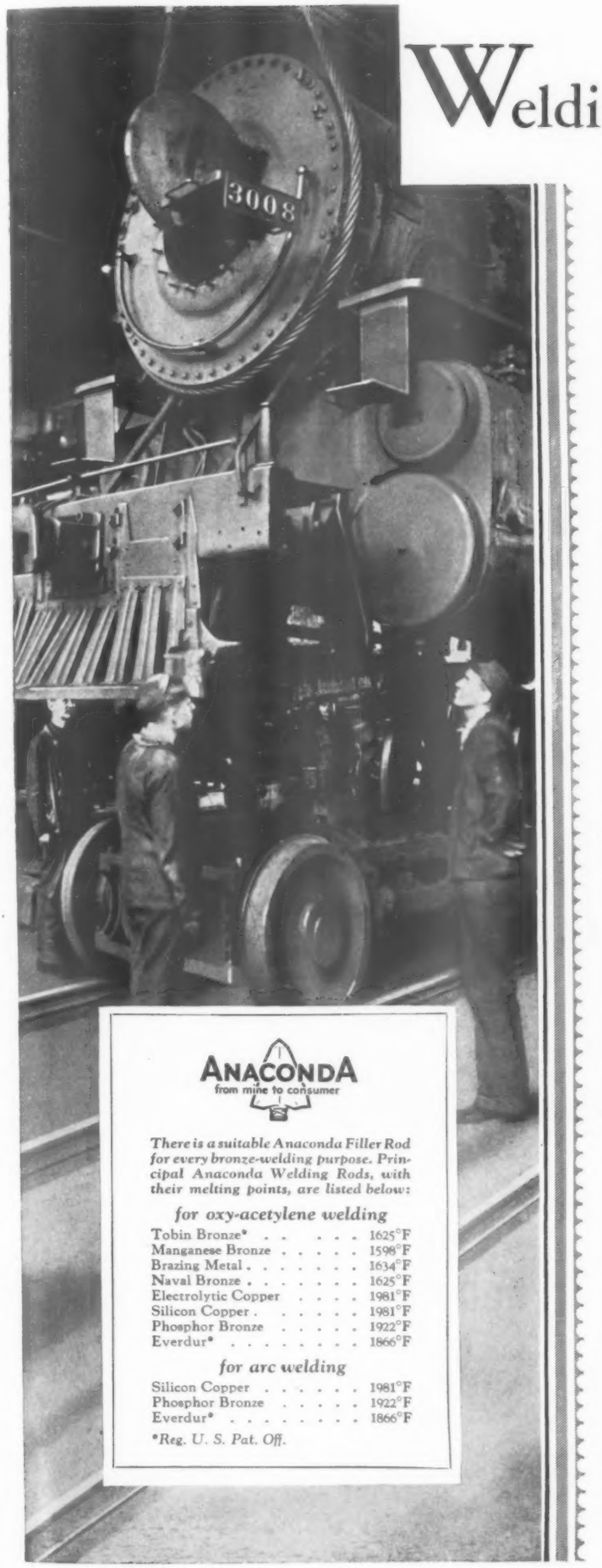
A. G. Bissell, consulting arc welding engineer, recently visited the East Pittsburgh Works of the Westinghouse Electric & Manufacturing Co., where he studied the erection of the arc-welded $1,500,000 engineering laboratory now under construction. Mr. Bissell, who is now located in Seattle, Wash., was with the Westinghouse company from 1923 to 1929. He has been in the east to attend the spring meeting of the American Welding Society in New York, and stopped at East Pittsburgh on his way back to Seattle.

Announcement was recently made of the advancement of Harold F. Kneen to plant superintendent of The Lincoln Electric Co., of Cleveland, Ohio. Superintendent Kneen came to this company as Assistant Plant Superintendent in June, 1929. Previous to that time he held positions with the Indiana Flooring Co. as superintendent of their Ironton, Ohio, plant, and as heat-transfer engineer for the Ingersoll Rand Co.

The Vernon Welding & Machine Shop, of Los Angeles, Calif., recently added a new 500-amp. Shrader electric generator to their shop at 2227 East 38th St. The shop, which is owned and operated by F. P. Nobbe and E. P. Frock, is well equipped for all classes of general repair welding and machine work. A special service is maintained in steam-shovel repairing, axles, drive-shafts, rear housings, and all truck parts.

The Standard Oil Co. in southern California is finishing extensive alterations and additions to their gasoline plant at El Segundo. The work, which has furnished employment for over a hundred welders for the past several months, includes the completion of a five-tube still containing a battery of eight pressure stills. Also extensive alterations are being made on six old pressure stills. In addition, welded floating roofs have been placed on six 120,000-barrel storage tanks of the Standard's El Segundo tank farm. The El Segundo plant is considered the largest gasoline plant in California, and ranks second largest in the world.

E. C. Frey, formerly general manager of the Harrisburg Pipe & Pipe Bending Co., and F. D. Andrews, formerly general superintendent of the same company, have opened offices in the Lewis Tower Building in Philadelphia. The new organization, trading under the name of the Andrews-Frey



Welding costs reduced 78% by using TOBIN BRONZE

IN the repair shops of a large railroad Tobin Bronze has again demonstrated its superiority over iron, as a welding material. The two metals were used on identical jobs—filling in on a crane turret base casting. Cost details are given below for comparison:

	Iron	Tobin Bronze
Labor	$ 6.40	$ 1.20
Welding Rod	1.20	2.46
Gas	24.96	3.51
	$32.56	$ 7.17
Reduction in cost		$25.39

The above figures were taken from a Neilsen Survey. Copy furnished upon request.

Tobin Bronze Welding saves time and gas because the relatively low temperature required usually eliminates extensive preheating. As a result, many repairs can be made in place without the necessity of dismantling and re-assembling. The low welding temperature employed also minimizes the risk of warping and shrinkage... And a properly made Tobin Bronze Weld in cast-iron is stronger than the casting itself.

The uniform composition and high quality of Anaconda Copper Alloy Welding Rods are due to the experience and technical knowledge of The American Brass Company in developing alloys suitable for all bronze-welding purposes. Publication B-13 contains full information.

THE AMERICAN BRASS COMPANY

General Offices: Waterbury, Connecticut

Canadian Mill: Anaconda American Brass Ltd.
New Toronto, Ontario

ANACONDA
WELDING RODS

ANACONDA
from mine to consumer

There is a suitable Anaconda Filler Rod for every bronze-welding purpose. Principal Anaconda Welding Rods, with their melting points, are listed below:

for oxy-acetylene welding

Tobin Bronze*	1625°F
Manganese Bronze	1598°F
Brazing Metal	1634°F
Naval Bronze	1625°F
Electrolytic Copper	1981°F
Silicon Copper	1981°F
Phosphor Bronze	1922°F
Everdur*	1866°F

for arc welding

Silicon Copper	1981°F
Phosphor Bronze	1922°F
Everdur*	1866°F

*Reg. U. S. Pat. Off.

Sales Co., will handle cylinders for high-pressure gases, steel billets and bars, and other steel products.

The Signal Oil Co., of Signal Hill, Calif., is furnishing employment for several welders at this time in the installation of a three-unit compressor plant and a three-mile high-pressure pipe line. The line, which is all-acetylene-welded, extends from the company plants on Signal Hill to about 40 producing wells in that field. Regular 6-in. rotary drill pipe is being used in this line, and, when in use, the line will carry 800 lb. pressure. The compressors being installed are of the Worthington make. The J. B. Gill Gas Engineering Co., of Signal Hill, and the Fluor Corporation, of Los Angeles, have the contracts for this work.

The Prest-O-Lite Co., Inc., 30 East 42nd St., New York, N. Y., announces the opening of a new plant for the manufacture of dissolved acetylene at 1240 Stewart Ave., S. W., Atlanta, Ga. The new plant is designed to take care of the demand occasioned by the increased use of the oxy-acetylene process in this industrial area. It is situated on a private siding of the Atlanta and West Point Railroad. With the opening of the new plant, the old plant at 345 Kuhrt St. S. W., Atlanta, will discontinue operations.

N. A. Strand & Co., 5001 N. Lincoln St., Chicago, have appointed Frecker Bros., Inc., 30 Church St., New York, N. Y., as their direct representatives for flexible shafts and related equipment in eastern New York State and northern New Jersey, succeeding W. B. DaSilva, who served in that capacity for the past ten years.

Welding exhibits at the Master Boiler Makers' Convention held in Pittsburgh during the week of May 20th were arranged by the Air Reduction Sales Co., Chicago Eye Shield Co., the Oxweld Railway Service Co., John A. Roebling's Sons Co., Jos. T. Ryerson & Son, Torchweld Equipment Co., Westinghouse Electric & Mfg. Co., and Willson Products, Inc.

It is reported that the Superior Welding & Repair Co., of Newark, N. J., will soon locate a one-story shop building at 48 Goble St.

The Burdett Oxygen Co., of Oklahoma City, Okla., a unit of Compressed Industrial Gases, Inc., recently sent out announcements through the southwestern territory that they have inaugurated a new and complete equipment-repair bureau. The announcement states that a complete line of tools and machinery has been installed, enabling them to make equipment repairs in a most satisfactory manner and that the repair work will be handled by skilled mechanics who have been thoroughly trained.

It is reported that 6,000 sq. ft. of additional floor space will be provided by the construction of a one-story addition to the plant of the Wackman Welded Ware Co., located at 1617 Silver St., Houston, Texas.

A new shop was recently started by the Lunsford Welding Co. at Jackson, Miss. Another recent addition to the list of welding shops in Jackson, Miss., is Cassidy & Hasell.

The Magic City Machine Shop, which started operations a short time ago at Bogalusa, La., includes a well equipped welding repair department.

Chas. M. Rusk, who has for several years been associated with the R. D. Thomas Co., was recently appointed welding engineer of Arcos, Inc., of Philadelphia, Pa., and La Crosse, Wis.

The Wm. M. Orr Co., of Pittsburgh, Pa., recently opened up a new store at 17th St. and St. Clair Ave., Cleveland, Ohio, carrying a complete line of Victor and Stoody products and supplies for gas and electric welding. R. G. Crouch is the manager.

A new one-story plant costing $50,000 with equipment is soon to be erected by the Kansas City Oxygen Co., Kansas City, Mo., at Madison Ave. and Woodswether Road, according to a recent report.

Reports received of the expansion plans of the Quick Welding & Machine Co., Terre Haute, Ind., including the installation of considerable new equipment, indicates that they have recently been enjoying a healthy increase in business.

At the meeting of the Association of Iron & Steel Electrical Engineers, which will be held in Buffalo the 16th to the 20th of this month, J. B. Austin of the Una Welding & Bonding Co., Cleveland, Ohio, is scheduled to read a paper on applying the principles of steel-mill practice to arc welding.

Lectures of interest to the welding industry scheduled for the meeting of the American Society for Testing Materials on June 24th include one on Fatigue Tests of Fillet Welds by R. E. Peterson and C. H. Jennings, and one on Silver Solders by D. L. Colwell. Papers of particular interest to the aircraft welders are included in the symposium on aircraft. T. W. Downes has prepared a paper on the joining of aircraft materials, welding, brazing, etc. H. L. Whittemore will speak on Procedure Control in Aircraft Welding, and Ancel St. John on the X-Ray Testing of Aircraft Materials.

It is reported that work has already begun on the new plant of the Wilson Welder & Metals Co., Hoboken, N. J. This is a one-story plant located at North Bergen, N. J.

C. E. Phillips & Co., Detroit, Mich., have opened an office at 37 Campau Ave., Grand Rapids, Mich., for the sale of Stoody products, welding wire, Tube-Turns, welding flanges, and all-welded specialties. J. C. Menzies is in charge.

R. L. Browne of the Metal & Thermit Corp. read a paper on the subject of Thermit Welding, which was illustrated by lantern slides and moving pictures, at the monthly meeting of the Western New York Section of the American Welding Society, held at the Statler Hotel, Buffalo, N. Y., on May 26th. The lecture and discussion were followed by a demonstration of thermit welding.

Jos. T. Ryerson & Son, Inc., of Chicago, recently purchased the plant of the Tioga Steel & Iron Co., which is located at 52nd St. & Grays Ave., Philadelphia, Pa., and will establish a Philadelphia branch office at that location.

Questions regarding the possibility of depositing hard-facing materials with the electric arc, welding malleable iron, the best method of welding a cast-iron cylinder block having a fracture in the inner wall of the water jacket, disposition of gas cylinders in case of fire, weldability of a metallic surface made by a torch cut, avoiding distortion in reinforcing a channel section with a welded plate inside the flange, and other questions were brought up for discussion at the regular monthly meeting of the Australian Welding Institute, held in the Working Men's College, Latrobe St., Melbourne, on the evening of May 22nd.